


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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a **PROVISIONAL APPLICATION FOR PATENT** under 37 CFR 1.53 (C).

CASE NUMBER		20255PV
INVENTOR(S)		
Given Name (first and middle [if any])	Family Name or Surname	Residence (City and Either State or Foreign Country)
Michel Nicholas Marc Michel Nathalie Chun Laird A.	Belle Lachance Labelle Gallant Chauvet Li Trimble	Pierrefonds, Quebec Canada Pierrefonds, Quebec Canada Ville Ile Perrot, Quebec Canada Pierrefonds, Quebec Canada Ile Bizzard, Quebec Canada Kirkland, Quebec Canada Pierrefonds, Quebec Canada
<input type="checkbox"/> Additional inventors are being named on the__ separately numbered sheets attached hereto		
TITLE OF THE INVENTION (280 characters max)		
PROSTAGLANDIN RECEPTOR LIGANDS		
CORRESPONDENCE ADDRESS		
Merck & Co., Inc. Patent Department - RY60-30 P.O. Box 2000 Rahway		
STATE	New Jersey	ZIP CODE 07065 COUNTRY U.S.A.
ENCLOSED APPLICATION PARTS (check all that apply)		
<input checked="" type="checkbox"/> Specification	Number of Pages 73	<input type="checkbox"/> Small Entity Statement
<input type="checkbox"/> Drawing(s)	Number of Sheets	<input type="checkbox"/> Other (specify)
METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT (check one)		
<input type="checkbox"/> A check or money order is enclosed to cover the filing fees		FILING FEE AMOUNT (\$) \$150.00
<input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge filing fees or credit to Deposit Account Number: 13-2755		

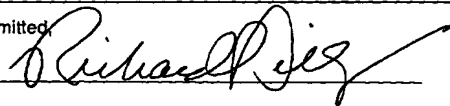
The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.

☐ Yes, the name of the U.S. Government agency and the Government contract number are: _____

Respectfully submitted,

SIGNATURE



Date 10/7/98

TYPED or PRINTED NAME RICHARD C. BILLUPS

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TELEPHONE 732-594-4683

EXPRESS MAIL CERTIFICATE

DATE OF DEPOSIT October 7, 1998
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5 TITLE OF THE INVENTION
PROSTAGLANDIN RECEPTOR LIGANDS

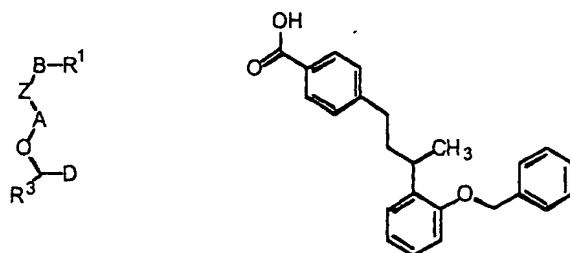
BACKGROUND OF THE INVENTION

10 This invention relates to compounds and methods for treating prostaglandin mediated diseases, and certain pharmaceutical compositions thereof. More particularly, the compounds of the invention are structurally different from NSAIDs and opiates, and are antagonists of the pain and inflammatory effects of E-type prostaglandins.

15 Two review articles describe the characterization and therapeutic relevance of the prostanoid receptors as well as the most commonly used selective agonists and antagonists: *Eicosanoids: From Biotechnology to Therapeutic Applications*, Folco, Samuelsson, Macclouf, and Velo eds, Plenum Press, New York, 1996, chap. 14, 137-154 and Journal of Lipid Mediators and Cell Signalling, 1996, 14, 83-87. An
20 article from *The British Journal of Pharmacology* (1994, 112, 735-740) suggests that Prostaglandin E₂ (PGE₂) exerts allodynia through the EP₁ receptor subtype and hyperalgesia through EP₂ and EP₃ receptors in the mouse spinal cord.

25 Thus, selective prostaglandin ligands, agonists or antagonists, depending on which prostaglandin E receptor subtype is being considered, have anti-inflammatory, antipyretic and analgesic properties similar to a conventional non-steroidal anti-inflammatory drug, and in addition, inhibit hormone-induced uterine contractions and have anti-cancer effects. These compounds have a diminished
30 ability to induce some of the mechanism-based side effects of NSAIDs which are indiscriminate cyclooxygenase inhibitors. In particular, the compounds have a reduced potential for gastrointestinal toxicity, a reduced potential for renal side effects, a reduced effect on bleeding times and a lessened ability to induce asthma attacks in aspirin-
35 sensitive asthmatic subjects.

PCT application nos WO 96/06822 (March 7, 1996), WO 96/11902 (April 25, 1996), WO 97/00863 (January 9, 1997), WO 97/00864 (January 9, 1997), WO 96/03380 (February 8, 1996), and EP 752421-A1 (January 08, 1997) disclose compounds represented by Formula I as
40 being useful in the treatment of prostaglandin mediated diseases.



5

I

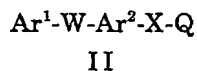
Ia

wherein:

- 10 A is phenyl, naphthyl, 5- or 6- membered heteroaryl
 B is phenyl, 5- or 6- membered heteroaryl or a further defined keto-
 dihydro ring;
 D is phenyl, 5- or 6- membered heteroaryl;
 R¹ is COOH, carboxyalkyl, tetrazolyl(alkyl);
 15 R³ is H or alkyl, and
 Z is an alkylene bridge containing 0-1 nitrogen atom or a further defined
 unsaturated bridge.
 Compound Ia is one of the compounds specifically claimed.

20 SUMMARY OF THE INVENTION

The present invention relates to compounds represented by
 formula II:



- 25 as well as pharmaceutically acceptable salts and hydrates thereof,
 wherein:

Ar¹ is an aryl or heteroaryl group, optionally substituted
 with R¹ or R³;

- 30 R¹ is Y_m-R², Y_m-Ar³, halogen, N(R⁵)₂, CN, NO₂, C(R⁶)₃,
 CON(R⁵)₂, S(O)_nR⁷ or OH;

Y represents a linker between R² or Ar³ and Ar¹ containing
 0-4 carbon atoms and not more than one heteroatom selected from O, N
 and S, said linker optionally containing CO, S(O)_n, -C=C- or an acetylenic
 group, and said linker being optionally substituted by R²;

- 35 m is 0 or 1;
 n is 0, 1 or 2;

- 5 R^2 represents H, F, CHF_2 , CF_3 , lower alkyl or hydroxyC₁₋₆ alkyl, or two R^2 groups may be joined together and represent a carbocyclic ring of up to six members, said ring containing not more than one heteroatom selected from O, N and S;
- 10 Ar^3 represents an aryl or heteroaryl group, optionally substituted with R^3 ;
 R^3 is R^4 , halogen, haloC₁₋₆alkyl, $\text{N}(\text{R}^5)_2$, CN, NO_2 , $\text{C}(\text{R}^6)_3$, $\text{CON}(\text{R}^5)_2$, OR^4 , SR^4 or $\text{S}(\text{O})_n\text{R}^7$;
 R^4 is H, lower alkyl, lower alkenyl, lower alkynyl, CHF_2 or CF_3 ;
- 15 R^5 is R^4 , Ph or Bn, or two R^5 groups in combination with the atom to which they are attached represent a ring of up to 6 members containing carbon atoms and up to 2 heteroatoms selected from O, N and S;
- 20 R^6 is H, F, CF_3 or lower alkyl, or two R^6 groups may be taken together and represent a ring of up to 6 members containing carbon atoms and 0-2 heteroatoms selected from O, N and S;
 R^7 is lower alkyl, lower alkenyl, lower alkynyl, CHF_2 , CF_3 , $\text{N}(\text{R}^5)_2$, $\text{Ph}(\text{R}^8)_2$ or $\text{CH}_2\text{Ph}(\text{R}^8)_2$;
 R^8 is R^4 , OR^4 , SR^4 or halogen
- 25 W represents a 3-6 membered linking group containing 0 to 2 heteroatoms selected from O, N and S, said linking group optionally containing CO, $\text{S}(\text{O})_n$, C=C or an acetylenic group, and optionally being substituted with R^9 ;
- 30 R^9 is R^2 , lower alkenyl, lower alkynyl, OR^4 or SR^4 ;
 Ar^2 represents an aryl or heteroaryl group, optionally substituted with R^3 ;
 R^{10} represents R^4 , halogen, $\text{N}(\text{R}^5)_2$, CN, NO_2 , $\text{C}(\text{R}^6)_3$, OR^4 , SR^4 or $\text{S}(\text{O})_n\text{R}^7$;
- 35 X represents a linker which is attached to Ar^2 ortho to the attachment of W, said linker containing 0-4 carbon atoms and not more than one heteroatom selected from O, N and S, said linker further optionally containing CO, $\text{S}(\text{O})_n$, C=C or an acetylenic group, and said linker being optionally substituted with R^{11} ;
 R^{11} is R^9 ;

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5 Q represents a member selected from the group consisting of: CO_2H , tetrazole, SO_3H , hydroxamic acid, $\text{CONHSO}_2\text{R}^{12}$ and $\text{SO}_2\text{NHCOR}^{12}$;

R^{12} represents a member selected from the group consisting of: CF_3 , lower alkyl, lower alkenyl, lower alkynyl and ZAr^4 , wherein Z is an optional linker containing 0-4 carbon atoms, optionally substituted with R^{13} ;

R^{13} is R^9 ;

Ar^4 is an aryl or heteroaryl group optionally substituted with R^{14} , and

15 R^{14} is R^{10} or NHCOMe .

Pharmaceutical compositions and methods of treatment are also included.

DETAILED DESCRIPTION OF THE INVENTION

20 The present invention relates to compounds represented by formula II:



II

as well as pharmaceutically acceptable salts and hydrates thereof, 25 wherein:

Ar^1 is an aryl or heteroaryl group, optionally substituted with R^1 or R^3 ;

R^1 is $\text{Y}_m\text{-R}^2$, $\text{Y}_m\text{-Ar}^3$, halogen, $\text{N}(\text{R}^5)_2$, CN , NO_2 , $\text{C}(\text{R}^6)_3$, $\text{CON}(\text{R}^5)_2$, $\text{S}(\text{O})_n\text{R}^7$ or OH ;

30 Y represents a linker between R^2 or Ar^3 and Ar^1 containing 0-4 carbon atoms and not more than one heteroatom selected from O, N and S, said linker optionally containing CO , $\text{S}(\text{O})_n$, -C=C- or an acetylenic group, and said linker being optionally substituted by R^2 ;

m is 0 or 1;

35 n is 0, 1 or 2;

R^2 represents H, F, CHF_2 , CF_3 , lower alkyl or hydroxy C_{1-6} alkyl, or two R^2 groups may be joined together and represent a carbocyclic ring of up to six members, said ring containing not more than one heteroatom selected from O, N and S;

40 Ar^3 represents an aryl or heteroaryl group, optionally substituted with R^3 ;

5 R^3 is R^4 , halogen, haloC₁₋₆alkyl, $N(R^5)_2$, CN, NO_2 , $C(R^6)_3$,
CON(R^5)₂, OR⁴, SR⁴ or S(O)_nR⁷;

R^4 is H, lower alkyl, lower alkenyl, lower alkynyl, CHF₂ or
CF₃;

10 R^5 is R^4 , Ph or Bn, or two R^5 groups in combination with the
atom to which they are attached represent a ring of up to 6 members
containing carbon atoms and up to 2 heteroatoms selected from O, N and
S;

R^6 is H, F, CF₃ or lower alkyl, or two R^6 groups may be taken
together and represent a ring of up to 6 members containing carbon
15 atoms and 0-2 heteroatoms selected from O, N and S;

R^7 is lower alkyl, lower alkenyl, lower alkynyl, CHF₂, CF₃,
 $N(R^5)_2$, Ph(R^8)₂ or CH₂Ph(R^8)₂;

R^8 is R^4 , OR⁴, SR⁴ or halogen

20 W represents a 3-6 membered linking group containing 0 to
2 heteroatoms selected from O, N and S, said linking group optionally
containing CO, S(O)_n, C=C or an acetylenic group, and optionally being
substituted with R^9 ;

R^9 is R^2 , lower alkenyl, lower alkynyl, OR⁴ or SR⁴;

25 Ar² represents an aryl or heteroaryl group, optionally
substituted with R^3 ;

R^{10} represents R^4 , halogen, $N(R^5)_2$, CN, NO_2 , $C(R^6)_3$, OR⁴,
SR⁴ or S(O)_nR⁷;

30 X represents a linker which is attached to Ar² ortho to the
attachment of W, said linker containing 0-4 carbon atoms and not more
than one heteroatom selected from O, N and S, said linker further
optionally containing CO, S(O)_n, C=C or an acetylenic group, and said
linker being optionally substituted with R^{11} ;

R^{11} is R^9 ;

35 Q represents a member selected from the group consisting
of: CO₂H, tetrazole, SO₃H, hydroxamic acid, CONHSO₂R¹² and
SO₂NHCOR¹²;

40 R^{12} represents a member selected from the group consisting
of: CF₃, lower alkyl, lower alkenyl, lower alkynyl and ZAr⁴, wherein Z
is an optional linker containing 0-4 carbon atoms, optionally substituted
with R^{13} ;

- 5 R^{13} is R^9 ;
 Ar^4 is an aryl or heteroaryl group optionally substituted
 with R^{14} , and
 R^{14} is R^{10} or $NHCOMe$.

- 10 As used herein, the following terms and definitions apply
 unless indicated otherwise.

The following abbreviations have the indicated meanings:

- | | | | |
|----|-------------------|---|--|
| | Ac | = | acetyl |
| | AIBN | = | 2,2'-azobisisobutyronitrile |
| 15 | Bn | = | benzyl |
| | DHP | = | 2,3-dihydro-4H-pyran |
| | DIBAL | = | diisobutyl aluminum hydride |
| | DIPHOS | = | 1,2-bis(diphenylphosphino)ethane |
| | DMAP | = | 4-(dimethylamino)pyridine |
| 20 | DMF | = | N,N-dimethylformamide |
| | DMSO | = | dimethyl sulfoxide |
| | EDCI | = | 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide
hydrochloride |
| | Et ₃ N | = | triethylamine |
| 25 | Fur | = | furandiyl |
| | HBBS | = | Hanks balanced salt solution |
| | HEPES | = | N-[2-hydroxyethyl]piperazine-N'-[2-
ethanesulfonic acid] |
| | KHMDS | = | potassium hexamethyldisilazane |
| 30 | LDA | = | lithium diisopropylamide |
| | LPS | = | lipopolysaccharide |
| | MCPBA | = | metachloroperbenzoic acid |
| | MES | = | 2-[N-morpholino]ethanesulfonic acid |
| | Ms | = | methanesulfonyl = mesyl |
| 35 | MsO | = | methanesulfonate = mesylate |
| | NBS | = | N-bromosuccinimide |
| | NCS | = | N-chlorosuccinimide |
| | NSAID | = | non-steroidal anti-inflammatory drug |
| | PCC | = | pyridinium chlorochromate |
| 40 | PDC | = | pyridinium dichromate |
| | Ph | = | phenyl |

5	Phe =	benzenediyl
	PPTS =	pyridinium p-toluenesulfonate
	pTSA =	p-toluenesulfonic acid
	Pye =	pyridinediyl
	r.t. =	room temperature
10	rac. =	racemic
	Tf =	trifluoromethanesulfonyl = triflyl
	TfO =	trifluoromethanesulfonate = triflate
	Th =	2- or 3-thienyl
	THF =	tetrahydrofuran
15	Thi =	thiophenediyl
	THP =	tetrahydropyran-2-yl
	Thz =	thiazol-2-yl
	TLC =	thin layer chromatography
	Ts =	p-toluenesulfonyl = tosyl
20	TsO =	p-toluenesulfonate = tosylate
	Tz =	1H (or 2H)-tetrazol-5-yl
	C ₃ H ₅ =	allyl

Alkyl group abbreviations

	Me =	methyl
25	Et =	ethyl
	n-Pr =	normal propyl
	i-Pr =	isopropyl
	n-Bu =	normal butyl
	i-Bu =	isobutyl
30	s-Bu =	secondary butyl
	t-Bu =	tertiary butyl
	c-Pr =	cyclopropyl
	c-Bu =	cyclobutyl
	c-Pen =	cyclopentyl
35	c-Hex =	cyclohexyl

The terms alkyl, alkenyl, and alkynyl mean linear, branched, and cyclic structures and combinations thereof.

"Alkyl" and the alkyl portions of alkoxy, arylalkyl, alkylaryl and the like include "cycloalkyl" and "lower alkyl" and extends to cover carbon fragments having up to 20 carbon atoms. Examples of alkyl

5 groups include octyl, nonyl, undecyl, dodecyl, tridecyl, tetradecyl, pentadecyl, eicosyl, 3,7-diethyl-2,2-dimethyl-4-propylnonyl, and the like.

"Lower alkyl" includes "lower cycloalkyl" and means alkyl groups of from 1 to 7 carbon atoms. Examples of lower alkyl groups include methyl, ethyl, propyl, isopropyl, butyl, s- and t-butyl, pentyl, 10 hexyl, heptyl, and the like.

"Cycloalkyl" includes "lower cycloalkyl" and means a hydrocarbon, containing one or more rings of from 3 to 12 carbon atoms, with the hydrocarbon having up to a total of 20 carbon atoms. Examples of cycloalkyl groups are cyclopropyl, cyclopentyl, cycloheptyl, adamantyl, 15 cyclododecylmethyl, 2-ethyl-1-bicyclo[4.4.0]decyl, and the like.

"Lower cycloalkyl" means a hydrocarbon containing one or more rings of from 3 to 7 carbon atoms, with the hydrocarbon having up to a total of 7 carbon atoms. Examples of lower cycloalkyl groups are cyclopropyl, cyclopropylmethyl, cyclobutyl, 2-cyclopentylethyl, 20 cycloheptyl, bicyclo[2.2.1]hept-2-yl, and the like.

The term "alkenyl" includes "cycloalkenyl" and "lower alkenyl" and means alkenyl groups of 2 to 20 carbon atoms. Examples of alkenyl groups include allyl, 5-decen-1-yl, 2-dodecen-1-yl, and the like. "Lower alkenyl" includes "lower cycloalkenyl" and means alkenyl 25 groups of 2 to 7 carbon atoms. Examples of lower alkenyl groups include vinyl, allyl, isopropenyl, pentenyl, hexenyl, heptenyl, 1-propenyl, 2-butenyl, 2-methyl-2-butenyl, and the like.

"Cycloalkenyl" includes "lower cycloalkenyl" and means alkenyl groups of 3 to 20 carbon atoms, which include a ring of 3 to 12 30 carbon atoms, and in which the alkenyl double bond may be located anywhere in the structure. Examples of cycloalkenyl groups are cyclopropen-1-yl, cyclohexen-3-yl, 2-vinyladamant-1-yl, 5-methylene-dodec-1-yl and the like.

"Lower cycloalkenyl" means alkenyl groups of 3 to 7 carbon 35 atoms, which include a ring of 3 to 7 carbon atoms and in which the double bond may be located anywhere in the structure. Examples of lower cycloalkenyl groups are cyclopropen-1-yl, cyclohexen-3-yl, 2-cyclopentylethen-1-yl, and the like.

The term "alkynyl" includes "cycloalkynyl" and "lower 40 alkynyl" and means alkynyl groups of 2 to 20 carbon atoms. Examples of

5 alkynyl groups are ethynyl, 2-pentadecyn-1-yl, 1-eicosyn-1-yl, and the like.

"Lower alkynyl" includes "lower cycloalkynyl" and means alkynyl groups of 2 to 7 carbon atoms. Examples of lower alkynyl groups include ethynyl, propargyl, 3-methyl-1-pentynyl, 2-heptynyl and the like.

10 "Cycloalkynyl" includes "lower cycloalkynyl" and means alkynyl groups of 5 to 20 carbon atoms, which include a ring of 3 to 20 carbon atoms. The alkynyl triple bond may be located anywhere in the group, with the proviso that if it is within a ring, such a ring must be of 10 members or greater. Examples of cycloalkynyl are cyclododecyn-3-yl,
15 3-cyclohexyl-1-propyn-1-yl, and the like.

"Lower cycloalkynyl" means alkynyl groups of 5 to 7 carbon atoms which include a ring of 3 to 5 carbon atoms. Examples of lower cycloalkynyl are cyclopropylethynyl, 3-(cyclobutyl)-1-propynyl, and the like.

20 Halogen includes F, Cl, Br and I. When a group is "halogenated", it is substituted with one or more halogen atoms, up to the maximum number of positions available for substitution, i.e., it is "perhalogenated".

The definition of any substituent (e.g., R^6 , R^{10} , etc.) in a
25 particular molecule is independent of its definition elsewhere in the molecule. Thus, $-N(R^5)_2$ represents $-NHH$, $-NHCH_3$, $-NHC_6H_5$, and the like.

Examples of rings formed when two R^2 groups join include cyclopropane, cyclobutane, cyclopentane, cyclohexane, cycloheptane,
30 oxetane, tetrahydrofuran, tetrahydropyran, tetrahydrothiophene, tetrahydrothiopyran, pyrrolidine and piperidine.

The heterocycles formed when two R^5 groups join through N include pyrrolidine, piperidine, morpholine, thiamorpholine, piperazine and N-methylpiperazine.

35 Aryl and the aryl portions of arylalkyl, aryloxy, arylalkoxy and the like refer to aromatic as well as partially aromatic 6-12 membered ring systems. Examples include benzene, naphthalene, biphenyl and tetrahydronaphthalene.

Heteroaryl and the heteroaryl portion of heteroarylalkyl,
40 heteroarylalkoxy, heteroaryloxy and the like refer to 5-15 membered aromatic and partially aromatic ring systems, containing 1-4

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- 5 heteroatoms selected from O, S and N. Examples include pyridine, quinoline, isoquinoline, furan, benzofuran, thiophene, benzothiophene, oxazole, thiazole, benzothiazole, 1,3,4-thiadiazole, thienopyridine, indole, tetrazole, imidazole, benzoxazole, pyrrole and methylenedioxyphenyl.

- Haloaryl and haloheteroaryl refer to aryl and heteroaryl groups respectively having at least one halo atom attached, up to perhalogenated, as indicated above. Haloalkyl refers to alkyl groups which have one or more halogen atoms attached, including up to the maximum number of positions which can be substituted, i.e., perhalogenated alkyl groups. In haloalkylarylalkoxy, the terminal alkyl portion is halogenated. In haloarylalkoxy, the aryl portion is halogenated, and in haloheteroarylalkoxy the heteroaryl portion is halogenated.

- Aryl, heteroaryl and other groups are termed optionally substituted as described herein. When a moiety is optionally substituted, this means that the moiety is unsubstituted or is substituted with 1-5 of the substituent groups, as permitted with respect to the availability for substitution. In particular, this applies to Ar¹, which is optionally substituted with 1-5 R¹ and/or R³ groups. Y is optionally substituted with 1-5 R² groups. Ar³ is optionally substituted with 1-5 R³ groups. W is optionally substituted with 1-5 R⁹ groups. Ar² is optionally substituted with 1-5 R³ groups. X is optionally substituted with 1-5 R¹¹ groups. Z is optionally substituted with 1-5 R¹³ groups, and Ar⁴ is optionally substituted with 1-5 R¹⁴ groups.

- Y represents an optional linking group between Ar¹ and R² or R³. When m is 0, Y is absent and when m is 1, Y is present. The linking group contains 0-4 carbon atoms and 0-1 heteroatoms selected from O, S and N, and further is optionally substituted with R². Examples of suitable linking groups include: O, S, NR², OCH₂, CH=CH, SO₂CH₂, NHCHMeCH₂O, CH₂, CH₂CH=CH and the like.

- W represents a 3-6 membered linking group containing 0 to 2 heteroatoms selected from O, N and S, said linking group optionally containing CO, S(O)_n, C=C or an acetylenic group, and optionally being substituted with R⁹. Examples include OCH₂CH₂, CH=CHCH₂, CH₂SO₂CH₂, NHCHMeCH₂, (CH₂)₅, CH₂CH=CHCH₂, O(CH₂)₃O, CH₂NHCO, CH₂C≡C, CH₂OCH₂, CH₂CH=CH, 1,2-c-Pr-CH₂, CH₂-1,2-c-Pr and the like.

5 X represents a linker that is attached to Ar² ortho to the attachment of W. The linker contains 0-4 carbon atoms and not more than one heteroatom selected from O, N and S. Linker X further optionally contains a group CO, S(O)_n, C=C or an acetylenic group, and said linker is optionally substituted with R¹¹. Examples of X include
 10 OCH₂, CH=CH, SO₂CH₂, NHCHMeCH₂O, CH₂, CH₂CH=CH, 1,2-c-Pr, (CH₂)₂O, C≡C and the like.

In ZAr⁴, Z represents an optional linker having 0-4 carbon atoms, and being optionally substituted with R¹³. Examples of such a linker include a bond, CH₂CH₂, CH=CH, CHMeCH₂, CH₂, CH₂CH=CH,
 15 1,2-c-Pr, and the like.

One aspect of the invention that is of particular interest relates to compounds of formula II wherein R¹ is OH, OCH₂Ar³, SCH₂Ar³, OAr³, SAR³ or NR²CH₂Ar³. Within this subset, all other variables are as originally defined.

20 Another aspect of the invention that is of particular interest relates to compounds of formula II wherein Ar³ is an aryl or heteroaryl group selected from the group consisting of benzene, pyridine, thiophene, furan, oxazole and thiazole, said group being optionally substituted with R³. Within this subset, all other variables are as
 25 originally defined.

Another aspect of the invention that is of particular interest relates to compounds of formula II wherein Ar² is an aryl or heteroaryl group selected from the group consisting of: benzene, pyridine, thiophene, furan, oxazole and thiazole, said group being optionally
 30 substituted with 1-5 groups selected from R⁴, OR⁴, SR⁴ and halogen.

Another aspect of the invention that is of particular interest relates to compounds of formula II wherein W is selected from the group consisting of: CH₂OCH₂, (CH₂)₃, CH₂CH=CH, CH=CHCH₂, CH(OH)CH=CH, CH=CHCH(OH), CH₂C≡C, C≡CCH₂, 1,2-c-Pr-CH₂ and
 35 -1,2-c-Pr-CH₂-. Within this subset, all other variables are as originally defined.

Another aspect of the invention that is of particular interest relates to compounds of formula II wherein X is selected from the group consisting of: (CH₂)₂, CH=CH, C≡C and 1,2-c-Pr. Within this subset, all
 40 other variables are as originally defined.

5 Another aspect of the invention that is of particular interest relates to compounds of formula II wherein Q is CO₂H or tetrazole. Within this subset, all other variables are as originally defined.

Another aspect of the invention that is of particular interest relates to compounds of formula II wherein Z represents a 0-2 carbon
10 atom linker that is unsubstituted. Within this subset, all other variables are as originally defined.

Another aspect of the invention that is of particular interest relates to compounds of formula II wherein Ar⁴ represents an aryl or heteroaryl group selected from the group consisting of benzene,
15 pyridine, thiophene, furan, oxazole, thiazole, 1,3,4-thiadiazole and naphthalene, said group being optionally substituted with R³. Within this subset, all other variables are as originally defined.

A preferred aspect of the invention relates to compounds represented by formula II wherein:

20 Ar¹ is an aryl or heteroaryl group substituted by R¹ and R³;

R¹ is OH, OCH₂Ar³, SCH₂Ar³, OAr³, SAr³ or NR²CH₂Ar³;

Ar³ is selected from the group consisting of benzene, pyridine, thiophene, furan, oxazole and thiazole, said group being optionally substituted with R³;

25 Ar² represents a member selected from the group consisting of: benzene, pyridine, thiophene, furan, oxazole, and thiazole, said group being optionally substituted with 1-4 members selected from the group consisting of: R⁴, OR⁴, SR⁴ and halogen;

30 W is selected from the group consisting of: CH₂OCH₂, (CH₂)₃, CH₂CH=CH, CH=CHCH₂, CH(OH)CH=CH, CH=CHCH(OH), CH₂C≡C, C≡CCH₂, 1,2-c-Pr-CH₂- and -CH₂-1,2-c-Pr-;

X is selected from the group consisting of: (CH₂)₂, CH=CH, C≡C and 1,2-c-Pr;

35 and Q is CO₂H or tetrazole. Within this subset, all other variables are as originally defined.

Another preferred aspect of the invention relates to compounds represented by formula II wherein:

Ar¹ is an aryl or heteroaryl group optionally substituted with R¹ and R³;

40 R¹ is OH, OCH₂Ar³, SCH₂Ar³, OAr³, SAr³ or NR₂CH₂Ar³;

5 Ar³ represents a member selected from the group consisting of: benzene, pyridine, thiophene, furan, oxazole or thiazole, said group being optionally substituted with R³;

W is selected from the group consisting of: CH₂OCH₂, (CH₂)₃, CH₂CH=CH, CH=CHCH₂, CH(OH)CH=CH, CH=CHCH(OH),
10 CH₂C≡C or C≡CCH₂;

Ar² represents a member selected from the group consisting of: benzene, pyridine, thiophene, furan, oxazole or thiazole, said group being optionally substituted with R⁸;

X is selected from the group consisting of: (CH₂)₂,
15 CH=CH, C≡C and 1,2-c-Pr;

Q is CONHSO₂ZAr⁴;

Z is a 0-2 carbon linker and is unsubstituted;

Ar⁴ is selected from the group consisting of: benzene, pyridine, thiophene, furan, oxazole, thiazole, 1,3,4-thiadiazole and
20 naphthalene, and is optionally substituted by R³. Within this subset, all other variables are as originally defined.

A more preferred aspect of the invention relates to compounds represented by formula II wherein:

Ar¹ is benzene or thiophene substituted in position 2 and/or
25 position 4 relative to the attachment of W with a member selected from the group consisting of: OH, OCH₂Ar³, SCH₂Ar³, OAr³, SAr³ and NR²CH₂Ar³, and is optionally substituted in position 3 with a member selected from the group consisting of: OMe, OCHF₂ and lower alkyl;

Ar³ is benzene or thiophene, optionally substituted with R⁸;
30 W is selected from the group consisting of: CH₂OCH₂, (CH₂)₃, CH₂CH=CH, CH=CHCH₂, CH(OH)CH=CH and CH=CHCH(OH),

Ar² is benzene or thiophene, optionally substituted with 1-4 members selected from R⁴, OR⁴, SR⁴ and halogen;

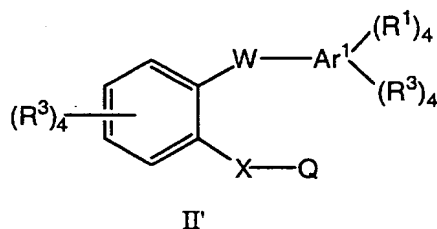
X represents a member selected from the group consisting
35 of: (CH₂)₂, CH=CH and 1,2-c-Pr, and

Q is CO₂H.

Within this subset, all other variables are as originally defined.

Another more preferred aspect of the invention relates to
40 compounds represented by formula II wherein:

- 5 Ar¹ is a benzene or a thiophene unsubstituted or substituted
in position 2 and/or position 4 relative to the point of attachment to W by
a member selected from the group consisting of: OH, OCH₂Ar³,
SCH₂Ar³, OAr³, SAr³ and NR²CH₂Ar³; and is optionally substituted at
position 3 with one member selected from the group consisting of: OMe,
10 OCHF₂ and lower alkyl;
Ar³ is benzene or thiophene, optionally substituted with R⁸;
W is selected from the group consisting of: CH₂OCH₂,
(CH₂)₃, CH₂CH=CH, CH=CHCH₂, CH(OH)CH=CH and CH=CHCH(OH);
Ar² is benzene or thiophene, optionally substituted with R⁴,
15 OR⁴, SR⁴ or halo;
X is selected from the group consisting of: (CH₂)₂, CH=CH
and 1,2-c-Pr,
Q is CONHSO₂ZAr⁴,
Z is a bond or CH₂, and
20 Ar⁴ is selected from the group consisting of: benzene,
thiophene, 1,3,4-thiadiazole and naphthalene and is substituted with R⁸.
Within this subset, all other variables are as originally
defined.
A particularly preferred aspect of the present invention that
25 is of interest relates to compounds represented by formula II':



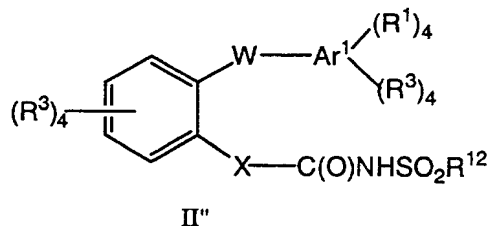
as well as pharmaceutically acceptable salts and hydrates thereof,
wherein:

- 30 Ar¹ represents phenyl, naphthyl, benzofuranyl or
methylenedioxyphenyl;
R¹ represents H, OH, C₁-6alkyl, C₁-6alkoxy, hydroxyC₁-
6alkyl, aryl, aryloxy, arylalkoxy, haloaryl, haloheteroaryl,
haloarylalkoxy, alkylaryl, haloalkylarylalkoxy, haloarylalkoxy and
haloheteroarylalkoxy;

- 5 R^3 represents R^4 , halogen, OR^4 or SR^4 ;
 R^4 represents H, lower alkyl, lower alkenyl, lower alkynyl,
 CHF_2 or CF_3 ;
 X represents a member selected from the group consisting
of:
10 $-(CH_2)_{1-2}$ -, 1,2-c-Pr, $-CH=CH-$, $-CH_2O-$, $-C\equiv CCH_2-$, $-C\equiv C-$, and $-CH_2-$
 $C\equiv C-$;

- W represents a member selected from the group consisting
of:
 $-(CH_2)_{3-6}$ -, $-CH_2CH=CH-$, $-CH=CHCH_2-$, $-CH(OH)CH=CH-$,
15 $-CH=CHCH(OH)-$, $-CH_2$ -, 1,2-c-Pr-, -1,2-c-Pr- CH_2- , $-CH_2-O-CH_2-$,
 $-O-(CH_2)_{1-3}-O-$, $-CH_2-NHC(O)-$, $-CF_2CH=CH-$, $-CH=CHCF_2-$, $-CH_2CH_2-$
 $S-$, $-S-CH_2CH_2-$, $-CH_2CH_2-SO_2-$, $-SO_2-CH_2CH_2-$, $-O-(CH_2)_{1-3}-$, $-(CH_2)_{1-3}-$
 $O-$ and $-CH=CHCH_2CH_2-$, and
20 all other variables are as originally defined.

Another particularly preferred aspect of the invention
relates to compounds represented by formula II":



- 25 as well as pharmaceutically acceptable salts and hydrates thereof,
wherein:

Ar^1 represents phenyl, naphthyl, benzofuranyl or
methylenedioxyphenyl;

- 30 R^1 represents H, OH, C_{1-6} alkyl, C_{1-6} alkoxy, hydroxy C_{1-6}
alkyl, aryl, aryloxy, arylalkoxy, haloaryl, haloheteroaryl,
haloarylalkoxy, alkylaryl, haloalkylarylalkoxy, haloarylalkoxy and
haloheteroarylalkoxy;

R^3 represents R^4 , halogen, OR^4 or SR^4 ;

5 R^4 represents H, lower alkyl, lower alkenyl, lower alkynyl, CHF_2 or CF_3 ;

X represents a member selected from the group consisting of:

10 $-(\text{CH}_2)_{1-2}$ -, $-1,2\text{-c-Pr-}$, $-\text{CH}=\text{CH-}$, $-\text{CH}_2\text{O-}$, $-\text{C}\equiv\text{CCH}_2\text{-}$, $-\text{C}=\text{C-}$,
and $-\text{CH}_2\text{-C}\equiv\text{C-}$;

W represents a member selected from the group consisting of:

15 $-(\text{CH}_2)_{3-6}$ -, $-\text{CH}_2\text{CH}=\text{CH-}$, $-\text{CH}=\text{CHCH}_2\text{-}$, $-\text{CH}(\text{OH})\text{CH}=\text{CH-}$,
 $-\text{CH}=\text{CHCH}(\text{OH})\text{-}$, $-\text{CH}_2\text{-}1,2\text{-c-Pr-}$, $-1,2\text{-c-Pr-CH}_2\text{-}$, $-\text{CH}_2\text{-O-CH}_2\text{-}$, $-\text{O-}$
 $(\text{CH}_2)_{1-3}\text{-O-}$, $-\text{CH}_2\text{-NHC(O)-}$, $-\text{CF}_2\text{CH}=\text{CH-}$, $-\text{CH}=\text{CHCF}_2\text{-}$, $-\text{CH}_2\text{CH}_2\text{-S-}$,
 $-\text{S-CH}_2\text{CH}_2\text{-}$, $-\text{CH}_2\text{CH}_2\text{-SO}_2\text{-}$, $-\text{SO}_2\text{-CH}_2\text{CH}_2\text{-}$, $-\text{O-}(\text{CH}_2)_{1-3}\text{-}$, $-(\text{CH}_2)_{1-3}\text{-O-}$
and $-\text{CH}=\text{CHCH}_2\text{CH}_2\text{-}$, and

20 R^{12} is selected from the group consisting of: C_{1-6} alkyl, thienyl, phenyl, naphthyl, biphenyl, quinolinyl, thiadiazolyl, tetrazolyl, $-\text{CH}=\text{CH-phenyl}$, said thienyl, phenyl, naphthyl, biphenyl, quinolinyl, thiadiazolyl, tetrazolyl and $-\text{CH}=\text{CH-phenyl}$ groups being optionally substituted with R^3 .

25 Examples of compounds within the present application are the following:

Table I					
(Ar ¹ -W-Ar ² -X-Q)					
Ex	Ar ¹	W	Ar ²	X	Q
1	2-(BnO)-3-MePh	$(\text{CH}_2)_3$	1,2-Phe	$(\text{CH}_2)_2$	CO_2H
2	2-(BnO)-3-MePh	$\text{CH}_2\text{CH}=\text{CH}$	1,2-Phe	$\text{CH}=\text{CH}$	CONHSO_2 -2-thienyl
3	2-(BnO)-3-MePh	$\text{CH}=\text{CHCH}_2$	1,2-Phe	$\text{CH}=\text{CH}$	CONHSO_2 -2-thienyl
4	2-((2-Cl-4-FPh) CH_2O)-3- CF_3Ph	$\text{CH}_2\text{CH}=\text{CH}$	1,2-Phe	$\text{CH}=\text{CH}$	CO_2H
5	2-((2-Cl-4-FPh) CH_2O)-3- CF_3Ph	$\text{CH}=\text{CHCH}_2$	1,2-Phe	$\text{CH}=\text{CH}$	CO_2H

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6	2-(BnO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
7	2-(BnO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
8	4-(BnO)-3,5-(MeO) ₂ Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
9	4-(BnO)-3,5-(MeO) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
10	2-(BnO)-5-AcPh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
11	2-(BnO)-5-AcPh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
12	2-(BnO)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
13	2-(BnO)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
14	4-(BnO)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
15	4-(BnO)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
16	2-(BnO O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH ₂	CO ₂ Na
17	2-(BnO)-3-MePh	CH=CHCH ₂	1,2-Phe	CH ₂	CO ₂ Na
18	2-(BnO)-3-MePh	CH ₂ CH=CH	5-Cl-1,2-Phe	CH ₂	CO ₂ Na
19	2-(BnO)-3-MePh	CH=CHCH ₂	5-Cl-1,2-Phe	CH ₂	CO ₂ Na
20	4-(BnO)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	1,2-c-Pr	CO ₂ H
21	2-(BnO)-3-MePh	CH=CHCH ₂	4,5-(MeO) ₂ -1,2-Phe	CH=CH	CO ₂ H
22	2-(BnO)-3-MePh	CH ₂ CH=CH	4,5-(MeO) ₂ -1,2-Phe	CH=CH	CO ₂ H
23	3,4-(methylene dioxo)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
24	3,4-(methylene dioxo)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
25	Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
26	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
27	2-(HO)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
28	2-(BnO)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
29	2-(BnO)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
30	2-((7-Cl-2-quinolinyl)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
31	2-((7-Cl-2-quinolinyl)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
32	2-(BnO)-3-MePh	(CH ₂) ₃	1,2-Phe	bond	CO ₂ H
33	2-(BnO)-3-MePh	CH=CHCH ₂	1,2-Phe	bond	CO ₂ Na
34	2-(BnO)-3-MePh	CH ₂ CH=CH	1,2-Phe	bond	CO ₂ Na
35	2-(BnO)-3-MePh	(CH ₂) ₃	1,2-Phe	CH=CH	CO ₂ Na
36	2-(BnO)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CO ₂ Na

37	4-(BnO)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CO ₂ Na
38	4-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
39	4-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
40	3,4-(MeO) ₂ Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
41	3,4-(MeO) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
42	2-(BnO)Ph	CH(OH)CH=CH	1,2-Phe	CH=CH	CO ₂ Na
43	2-(BnO)-3-MePh	(CH ₂) ₃	1,2-Phe	(CH ₂) ₂	CONNaSO ₂ -2-thienyl
44	4-(BnO)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONNaSO ₂ -2-thienyl
45	4-(BnO)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONNaSO ₂ -2-thienyl
46	2-(BnO)-3-MePh	CH ₂ -1,2-c-Pr	1,2-Phe	CH=CH	CO ₂ Na
47	2-(BnO)-3-MePh	1,2-c-Pr-CH ₂	1,2-Phe	CH=CH	CO ₂ Na
48	2-(BnO)-3-MePh	CH(OH)CH=CH	1,2-Phe	CH=CH	CO ₂ Na
49	2-(BnO)-3-MePh	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
50	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
51	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH(OH)CH=CH	1,2-Phe	CH=CH	CO ₂ H
52	2-((4-FPh)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
53	2-((4-FPh)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
54	2-((3,4-F ₂ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
55	2-((3,4-F ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
56	2-((3,5-F ₂ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
57	2-((3,5-F ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
58	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-(HOCH ₂)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
59	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-(HOCH ₂)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
60	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
61	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
62	2-((4-CF ₃ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H

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63	2-((4-CF ₃ Ph) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
64	2-((4- (CHF ₂ O)Ph) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
65	2-((4-(CHF ₂ O) Ph)CH ₂ O)-3- MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
66	2-((4-CF ₃ Ph) CH ₂ O)-3- (HOCH ₂)Ph	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
67	2-((4-CF ₃ Ph) CH ₂ O)-3- (HOCH ₂)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
68	2-((4-CF ₃ Ph) CH ₂ O)-3-MePh	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
69	2-(PhCH ₂ O)-3- (HOCH ₂)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
70	3-(PhO)Ph	CH ₂ OCH ₂	1,2-Phe	CH=CH	CO ₂ Na
71	2-(PhO)Ph	CH ₂ OCH ₂	1,2-Phe	CH=CH	CO ₂ Na
72	3-(BnO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
73	3-(BnO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
74	2-(BnO)Ph	O(CH ₂) ₃ O	1,2-Phe	CH=CH	CO ₂ Na
75	2-(PhCHMeO)-3- -MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
76	2-(PhCHMeO)-3- -MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
77	3-(PhO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
78	3-(PhO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
79	3-Ph benzofuran-7-yl	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ Na
80	3-Ph benzofuran-7-yl	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ Na
81	Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
82	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
83	4-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
84	4-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
85	2-(BnO)-1-naphthyl	CH ₂ NHCO	1,2-Phe	CH=CH	CO ₂ H
86	2-((2-Cl-4-FPh) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
87	2-((2-Cl-4-FPh) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H

88	2-((2,4-F ₂ Ph) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
89	2-((2,4-F ₂ Ph) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
90	2-((2,4,6-F ₃ Ph) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
91	2-((2,4,6-F ₃ Ph) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
92	2-((2,6-Cl ₂ -4- FPh) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
93	2-((2,6-Cl ₂ -4- FPh) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
94	2-((2,4- F ₂ Ph)CH ₂ O) -3-(CHF ₂ O)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
95	2-((2,4-F ₂ Ph) CH ₂ O) -3-(CHF ₂ O)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
96	2-((4-FPh)CH ₂ O) -3-MePh	CF ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
97	2-((4-FPh)CH ₂ O) -3-MePh	CH=CHCF ₂	1,2-Phe	CH=CH	CO ₂ H
98	2-((4-FPh)CH ₂ O) -3-MePh	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ -(4-i- PrPh)
99	2-((4-FPh)CH ₂ O) -3-MePh	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ -(4-t- BuPh)
100	2-((4-FPh)CH ₂ O) -3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ -(4- (MeO)Ph)
101	2-((4-FPh)CH ₂ O) -3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -(2,3-Cl ₂ Ph)
102	2-((4-FPh)CH ₂ O) -3-MePh	CH=CHCH ₂	4-Cl-1,2-Phe	CH=CH	CONHSO ₂ -(5- Br-2-(MeO)Ph)
103	2-((4-FPh)CH ₂ O) -3-MePh	(CH ₂) ₂ S	3-F-1,2-Phe	CH=CH	CONHSO ₂ -(2,3,4-Cl ₃ Ph)
104	2-((4-FPh) CH ₂ O)-3-MePh	(CH ₂) ₂ S	6-CF ₃ -1,2- Phe	CH=CH	CONHSO ₂ -(5- F-2-MePh)
105	2-((4-FPh) CH ₂ O)-3-MePh	(CH ₂) ₂ S	4,5-F ₂ -1,2- Ph	CH=CH	CONHSO ₂ -(2,5-Me ₂ Ph)
106	2-((4-FPh) CH ₂ O)-3-MePh	(CH ₂) ₂ SO ₂	1,2-Phe	CH=CH	CONHSO ₂ -(4- CF ₃ Ph)
107	2-((4-FPh) CH ₂ O)-3-MePh	(CH ₂) ₂ SO ₂	1,2-Phe	CH=CH	CONHSO ₂ -2- naphthyl
108	2-((4-FPh) CH ₂ O)-3-MePh	CH=CHCH ₂	3-F-1,2-Phe	CH=CH	CONHSO ₂ -(3- Cl-4-FPh)
109	2-((4-FPh) CH ₂ O)-3-MePh	SO ₂ (CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(4- n-PrPh)

110	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	SO ₂ (CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(2- ClPh)
111	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	SO ₂ (CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(4- FPh)
112	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	S(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(2- PhPh)
113	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	S(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(2- CF ₃ Ph)
114	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	S(CH ₂) ₂	4-t-Bu-1,2- Phe	CH=CH	CONHSO ₂ -(4- Cl-2,5-Me ₂ Ph)
115	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	O(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ - (2,5-Cl ₂ Ph)
116	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	O(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(4- Br-2- (CF ₃ O)Ph)
117	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	O(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ - CH ₂ Ph
118	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	(CH ₂) ₂ O	1,2-Phe	CH=CH	CONHSO ₂ -1- naphthyl
119	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	(CH ₂) ₂ O	4,5-F ₂ -1,2- Phe	CH=CH	CONHSO ₂ -(2- FPh)
120	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	(CH ₂) ₂ O	1,2-Phe	CH=CH	CONHSO ₂ - (2,4-Cl ₂ Ph)
121	2-((4-FPh) CH ₂ O)-3- (MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ - CH=CHPh
122	2-((4- FPh)CH ₂ O)-3- (MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ - (3,5-(CF ₃) ₂ Ph)
123	2-((4- FPh)CH ₂ O)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ - (2,5-Cl ₂ -3- thienyl)
124	2-((4-FPh) CH ₂ O)Ph	(CH ₂) ₄	3-F-1,2-Phe	CH=CH	CONHSO ₂ -(3- BrPh)
125	2-((4-FPh) CH ₂ O)Ph	(CH ₂) ₄	3-MeO-1,2- Phe	CH=CH	CONHSO ₂ -(2- BrPh)
126	2-((4-FPh) CH ₂ O)Ph	(CH ₂) ₄	1,2-Phe	CH=CH	CONHSO ₂ -(2- NO ₂ Ph)

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127	2-((4-FPh) CH ₂ O)Ph	(CH ₂) ₅	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(3- ClPh)
128	2-((4-FPh) CH ₂ O)Ph	(CH ₂) ₅	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(4- (CF ₃ O)Ph)
129	2-HOPh	CH=CH(CH ₂) ₂	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -8- quinolinyl
130	2-((4-FPh) CH ₂ O)Ph	CH=CH(CH ₂) ₂	5-(CF ₃ O)- 1,2-Phe	(CH ₂) ₂	CONHSO ₂ - (3,4-Cl ₂ Ph)
131	4-((2,6-Cl ₂ -4- FPh)CH ₂ O)-3- MePh	CH=CH(CH ₂) ₂	3-F-1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(4- EtPh)
132	2-((4-FPh) CH ₂ O)Ph	CH ₂ CH=CH	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(4- Cl-2-NO ₂ Ph)
133	2-((4-FPh) CH ₂ O)Ph	CH=CHCH ₂	4,5-F ₂ -1,2- Phe	CH=CH	CONHSO ₂ -(2- Cl-3-Br-5- thienyl)
134	2-((4-FPh) CH ₂ O)Ph	CH ₂ CH=CH	4,5-F ₂ -1,2- Phe	CH=CH	CONHSO ₂ - (3,4-(MeO) ₂ Ph)
135	2-HOPh	CH=CHCH ₂	4,5-F ₂ -1,2- Phe	CH=CH	CONHSO ₂ - (2,5-Cl ₂ -3-Br-4- thienyl)
136	4-((4-FPh)CH ₂ O)- 3-(MeO)Ph	CH ₂ CH=CH	4,5-F ₂ -1,2- Phe	CH=CH	CONHSO ₂ -(4- Br-2,5-F ₂ Ph)
137	4-((4-FPh)CH ₂ O)- 3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -(5- (AcNH)-1,3,4- thiadiazol-2- yl)
138	4-((4-FPh) CH ₂ O)-3- (MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ - (2,3,4,5,6- F ₅ Ph)
139	4-((2-Cl-4-FPh) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -(2- CNPh)
140	2-((4-FPh) CH ₂ O)Ph	CH ₂ CH=CH	4-F-1,2-Phe	CH=CH	CONHSO ₂ -(2- Cl-6-MePh)
141	2-HOPh	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ - (2,4,6-Me ₃ Ph)
142	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ - (2,3-Br ₂ -2- thienyl)
143	2-((4-FPh) CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	CH ₂ O	CONHSO ₂ -(4- NO ₂ Ph)
144	2-((4-FPh) CH ₂ O)Ph	CH ₂ CH=CH	1,2-Phe	CH ₂ O	CONHSO ₂ - (3,5-Cl ₂ Ph)
145	2,4-((4-FPh) CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	prop-1-yne- 1,3-diyl	CONHSO ₂ -(5- Cl-2-thienyl)
146	4-((2,4-F ₂ Ph) CH ₂ O)-3- (MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH ₂ O	CONHSO ₂ -(4- CF ₃ Ph)

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147	2-HO-3-MePh	CH=CHCH ₂	1,2-Phe	CH ₂ O	CONHSO ₂ -(2,4-F ₂ Ph)
148	2-((4-FPh)CH ₂ O)Ph	CH ₂ CH=CH	4-F-1,2-Phe	1,2-ethyne diyl	CONHSO ₂ -(4-ClPh)
149	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	1,2-ethyne diyl	CONHSO ₂ -(3-CF ₃ Ph)
150	4-HOPh	CH ₂ CH=CH	1,2-Phe	1,2-ethyne diyl	CONHSO ₂ -Ph
151	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	prop-2-yne-1,3-diyl	CONHSO ₂ -(5-Br-2-thienyl)
152	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH ₂ CH=CH	1,2-Phe	1,2-ethynediyl	CONHSO ₂ -Me
153	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	1,2-c-Pr	CONHSO ₂ -(2,5-(MeO) ₂ Ph)
154	6-((4-FPh)CH ₂ O)-2-naphthyl	CH ₂ CH=CH	4-F-1,2-Phe	1,2-c-Pr	CONHSO ₂ -(3-MePh)
155	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	1,2-c-Pr	CONHSO ₂ -(4-MePh)
156	4-HO-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	1,2-c-Pr	CONHSO ₂ -n-Bu
157	4-((4-FPh)CH ₂ O)-1-naphthyl	CH=CHCH ₂	1,2-Phe	1,2-c-Bu	CONHSO ₂ -(2-Cl-4-FPh)
158	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ -(2-MePh)
159	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -c-Pr
160	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
161	4-((2,4-F ₂ Ph)CH ₂ O)-3-(MeO)Ph	(CH ₂) ₃	4-F-1,2-Phe	CH=CH	1H-tetrazol-5-yl
162	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	3-MeO-1,2-Phe	CH=CH	1H-tetrazol-5-yl
163	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	1H-tetrazol-5-yl
164	4-HO-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	1,2-c-Pr	1H-tetrazol-5-yl
165	Ph	CH=CHCH ₂	1,2-Phe	(CH ₂) ₂	1H-tetrazol-5-yl
166	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	SO ₃ H
167	2-((4-FPh)CH ₂ O)-3-MePh	(CH ₂) ₃	4-F-1,2-Phe	(CH ₂) ₂	SO ₃ H

5

Optical Isomers - Diastereomers - Geometric Isomers

Some of the compounds described herein contain one or more asymmetric centers and may thus give rise to diastereomers and

- 5 optical isomers. The present invention is meant to comprehend such possible diastereomers as well as their racemic and resolved, enantiomerically pure forms and pharmaceutically acceptable salts thereof.

- 10 Some of the compounds described herein contain olefinic double bonds, and unless specified otherwise, are meant to include both E and Z geometric isomers.

Salts

- The term "pharmaceutically acceptable salts" refers to salts prepared from pharmaceutically acceptable non-toxic bases including inorganic bases and organic bases. Salts derived from inorganic bases include aluminum, ammonium, calcium, copper, ferric, ferrous, lithium, magnesium, manganic, manganous, potassium, sodium, zinc salts, and the like. Particularly preferred are the ammonium, calcium, magnesium, potassium, and sodium salts. Salts derived from pharmaceutically acceptable organic non-toxic bases include salts of primary, secondary, and tertiary amines, substituted amines including naturally occurring substituted amines, cyclic amines, and basic ion exchange resins, such as arginine, betaine, caffeine, choline, N,N'-dibenzylethylenediamine, diethylamine, 2-diethylaminoethanol, 2-dimethylaminoethanol, ethanolamine, ethylenediamine, N-ethylmorpholine, N-ethylpiperidine, glucamine, glucosamine, histidine, hydrabamine, isopropylamine, lysine, methylglucamine, morpholine, piperazine, piperidine, polyamine resins, procaine, purines, theobromine, triethylamine, trimethylamine, tripropylamine, tromethamine, and the like.

- When the compound of the present invention is basic, salts may be prepared from pharmaceutically acceptable non-toxic acids, including inorganic and organic acids. Such acids include acetic, benzenesulfonic, benzoic, camphorsulfonic, citric, ethanesulfonic, fumaric, gluconic, glutamic, hydrobromic, hydrochloric, isethionic, lactic, maleic, malic, mandelic, methanesulfonic, mucic, nitric, pantoic, pantothenic, phosphoric, succinic, sulfuric, tartaric, p-toluenesulfonic acid, and the like. Particularly preferred are citric, hydrobromic, hydrochloric, maleic, phosphoric, sulfuric, and tartaric acids.

5 It will be understood that in the discussion of methods of
treatment which follows, references to the compounds of Formula II are
meant to also include the pharmaceutically acceptable salts and
hydrates.

10 Dose Ranges

 The magnitude of a prophylactic or therapeutic dose of a
compound of Formula II will, of course, vary with the nature and the
severity of the condition to be treated and with the particular compound
of Formula II and its route of administration. It will also vary
15 according to a variety of factors including the age, weight, general
health, sex, diet, time of administration, rate of excretion, drug
combination and response of the individual patient. In general, the
daily dose from about 0.001 mg to about 100 mg per kg body weight of a
mammal, preferably 0.01 mg to about 10 mg per kg. On the other hand,
20 it may be necessary to use dosages outside these limits in some cases.

 The active ingredient that may be combined with the carrier
materials to produce a single dosage form will vary depending upon the
host treated and the particular mode of administration. For example, a
formulation intended for oral administration to humans may contain
25 from as low as about 0.5 mg to as high as about 5 g of active agent,
compounded with an appropriate and convenient amount of carrier
material which may vary from about 5 to about 95 percent of the total
composition. Dosage units will generally contain between from about 1
mg to about 2 g of the active ingredient, typically 25 mg, 50 mg, 100 mg,
30 200 mg, 300 mg, 400 mg, 500 mg, 600 mg, 800 mg, or 1000 mg.

Pharmaceutical Compositions

 The pharmaceutical compositions of the present invention
comprise a compound of Formula II as an active ingredient or a
35 pharmaceutically acceptable salt or hydrate, thereof, and may also
contain a pharmaceutically acceptable carrier and optionally other
therapeutic ingredients.

 For the treatment of any of the prostanoid mediated diseases
compound II may be administered orally, topically, parenterally, by
40 inhalation spray or rectally in dosage unit formulations containing
conventional non-toxic pharmaceutically acceptable carriers, adjuvants

5 and vehicles. The term parenteral as used herein includes
subcutaneous injections, intravenous, intramuscular, intrasternal
injection or infusion techniques. In addition to the treatment of warm-
blooded animals such as mice, rats, horses, cattle, sheep, dogs, cats,
etc., the compound of the invention is effective in the treatment of
10 humans.

The pharmaceutical compositions containing the active
ingredient may be in a form suitable for oral use, for example, as tablets,
troches, lozenges, aqueous or oily suspensions, dispersible powders or
granules, emulsions, hard or soft capsules, or syrups or elixirs.
15 Compositions intended for oral use may be prepared according to any
method known to the art for the manufacture of pharmaceutical
compositions and such compositions may contain one or more agents
selected from the group consisting of sweetening agents, flavouring
agents, colouring agents and preserving agents in order to provide
20 pharmaceutically elegant and palatable preparations. Tablets contain
the active ingredient in admixture with non-toxic pharmaceutically
acceptable excipients which are suitable for the manufacture of tablets.
These excipients may be for example, inert diluents, such as calcium
carbonate, sodium carbonate, lactose, calcium phosphate or sodium
25 phosphate; granulating and disintegrating agents, for example, corn
starch, or alginic acid; binding agents, for example starch, gelatin or
acacia, and lubricating agents, for example, magnesium stearate,
stearic acid or talc. The tablets may be uncoated or they may be coated by
known techniques to delay disintegration and absorption in the
30 gastrointestinal tract and thereby provide a sustained action over a
longer period. For example, a time delay material such as glyceryl
monostearate or glyceryl distearate may be employed. They may also be
coated by the technique described in the U.S. Patent 4,256,108; 4,166,452;
and 4,265,874 to form osmotic therapeutic tablets for control release.
35 Formulations for oral use may also be presented as hard
gelatin capsules wherein the active ingredient is mixed with an inert
solid diluent, for example, calcium carbonate, calcium phosphate or
kaolin, or as soft gelatin capsules wherein the active ingredients is
mixed with water-miscible solvents such as propylene glycol, PEGs and
40 ethanol, or an oil medium, for example peanut oil, liquid paraffin, or
olive oil.

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5 Aqueous suspensions contain the active material in
admixture with excipients suitable for the manufacture of aqueous
suspensions. Such excipients are suspending agents, for example
sodium carboxymethylcellulose, methylcellulose, hydroxypropyl
methylcellulose, sodium alginate, polyvinylpyrrolidone, gum tragacanth
10 and gum acacia; dispersing or wetting agents may be a naturally-
occurring phosphatide, for example lecithin, or condensation products
of an alkylene oxide with fatty acids, for example polyoxyethylene
stearate, or condensation products of ethylene oxide with long chain
aliphatic alcohols, for example heptadecaethyleneoxycetanol, or
15 condensation products of ethylene oxide with partial esters derived from
fatty acids and a hexitol such as polyoxyethylene sorbitol monooleate, or
condensation products of ethylene oxide with partial esters derived from
fatty acids and hexitol anhydrides, for example polyethylene sorbitan
monooleate. The aqueous suspensions may also contain one or more
20 preservatives, for example ethyl, or n-propyl, p-hydroxybenzoate, one or
more colouring agents, one or more flavouring agents, and one or more
sweetening agents, such as sucrose, saccharin or aspartame.

Oily suspensions may be formulated by suspending the
active ingredient in a vegetable oil, for example arachis oil, olive oil,
25 sesame oil or coconut oil, or in mineral oil such as liquid paraffin. The
oily suspensions may contain a thickening agent, for example beeswax,
hard paraffin or cetyl alcohol. Sweetening agents such as those set forth
above, and flavouring agents may be added to provide a palatable oral
preparation. These compositions may be preserved by the addition of an
30 anti-oxidant such as ascorbic acid.

Dispersible powders and granules suitable for preparation
of an aqueous suspension by the addition of water provide the active
ingredient in admixture with a dispersing or wetting agent, suspending
agent and one or more preservatives. Suitable dispersing or wetting
35 agents and suspending agents are exemplified by those already
mentioned above. Additional excipients, for example sweetening,
flavouring and colouring agents, may also be present.

The pharmaceutical compositions of the invention may also
be in the form of an oil-in-water emulsion. The oily phase may be a
40 vegetable oil, for example olive oil or arachis oil, or a mineral oil, for
example liquid paraffin or mixtures of these. Suitable emulsifying

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5 agents may be naturally-occurring phosphatides, for example soy bean,
lecithin, and esters or partial esters derived from fatty acids and hexitol
anhydrides, for example sorbitan monooleate, and condensation
products of the said partial esters with ethylene oxide, for example
polyoxyethylene sorbitan monooleate. The emulsions may also contain
10 sweetening and flavouring agents.

Syrups and elixirs may be formulated with sweetening
agents, for example glycerol, propylene glycol, sorbitol or sucrose. Such
formulations may also contain a demulcent, a preservative and
flavouring and colouring agents. The pharmaceutical compositions
15 may be in the form of a sterile injectable aqueous or oleagenous
suspension. This suspension may be formulated according to the known
art using those suitable dispersing or wetting agents and suspending
agents which have been mentioned above. The sterile injectable
preparation may also be a sterile injectable solution or suspension in a
20 non-toxic parenterally-acceptable diluent or solvent, for example as a
solution in 1,3-butane diol. Among the acceptable vehicles and solvents
that may be employed are water, Ringer's solution and isotonic sodium
chloride solution. Cosolvents such as ethanol, propylene glycol or
polyethylene glycols may also be used. In addition, sterile, fixed oils are
25 conventionally employed as a solvent or suspending medium. For this
purpose any bland fixed oil may be employed including synthetic mono-
or diglycerides. In addition, fatty acids such as oleic acid find use in the
preparation of injectables.

Compound II may also be administered in the form of
30 suppositories for rectal administration of the drug. These compositions
can be prepared by mixing the drug with a suitable non-irritating
excipient which is solid at ambient temperatures but liquid at the rectal
temperature and will therefore melt in the rectum to release the drug.
Such materials are cocoa butter and polyethylene glycols.

35 For topical use, creams, ointments, gels, solutions or
suspensions, etc., containing the compound of Formula II are
employed. (For purposes of this application, topical application shall
include mouth washes and gargles.) Topical formulations may
generally be comprised of a pharmaceutical carrier, cosolvent,
40 emulsifier, penetration enhancer, preservative system, and emollient.

5 The composition of the present invention may also include additional therapeutic agents. For example, conventional analgesics such as aspirin or acetaminophen may be incorporated into the composition. Other examples of additional therapeutic agents which can be included are NSAIDs, such as ibuprofen or naproxen, COX-2
10 selective compounds, such as those which are described in the following patents and published applications: WO96/25405, U.S.Pat. No. 5,633,272, WO97/38986, U. S. Pat. No. 5,466,823, WO98/03484, WO97/14691 and WO95/00501, and other compounds.

15 Utilities

 The ability of the compounds of Formula II to interact with prostaglandin receptors makes them useful for preventing or reversing undesirable symptoms caused by prostaglandins in a mammalian, especially human, subject. This mimicking or antagonism of the
20 actions of prostaglandins indicates that the compounds and pharmaceutical compositions thereof are useful to treat, prevent, or ameliorate in mammals and especially in humans: Pain, fever and inflammation of a variety of conditions including rheumatic fever, symptoms associated with influenza or other viral infections, common
25 cold, low back and neck pain, skeletal pain, post-partum pain, dysmenorrhea, headache, migraine, toothache, sprains and strains, myositis, neuralgia, synovitis, arthritis, including rheumatoid arthritis, degenerative joint diseases (osteoarthritis), gout and ankylosing spondylitis, bursitis, burns including radiation and corrosive chemical
30 injuries, sunburns, pain following surgical and dental procedures as well as immune and autoimmune diseases. In addition, such a compound may inhibit cellular neoplastic transformations and metastatic tumor growth and hence can be used in the treatment of cancer. Compounds of formula II is also of use in the treatment and/or
35 prevention prostaglandin-mediated proliferation disorders such as may occur in diabetic retinopathy and tumor angiogenesis.

 Compounds of formula II inhibit prostanoid-induced smooth muscle contraction by antagonizing contractile prostanoids or mimicking relaxing prostanoids and hence may be use in the treatment
40 of dysmenorrhea, premature labor, asthma and eosinophil related disorders. It will also be of use in the treatment of Alzheimer's disease,

5 the treatment of glaucoma, for the prevention of bone loss (treatment of osteoporosis) and for the promotion of bone formation (treatment of fractures) and other bone diseases such as Paget's disease.

By virtue of its prostanoid or prostanoid antagonist activity, compound II are useful as an alternative to conventional non-steroidal
 10 anti-inflammatory drugs (NSAID'S) particularly where such non-steroidal anti-inflammatory drugs may be contraindicated such as in patients with peptic ulcers, gastritis, regional enteritis, ulcerative colitis, diverticulitis or with a recurrent history of gastrointestinal lesions; GI bleeding, coagulation disorders including anemia such as
 15 hypoprothrombinemia, haemophilia or other bleeding problems; kidney disease; thrombosis, occlusive vascular diseases; those prior to surgery or taking anti-coagulants. Compound II will also be useful as a cytoprotective agent for patients undergoing chemotherapy.

Consequently one aspect of the invention addresses a
 20 method of treating or preventing a prostaglandin mediated disease in a mammalian patient in need thereof, comprising administering to said patient a compound in accordance with formula II in an amount which is effective for treating or preventing said prostaglandin mediated disease.

25 In another aspect of the invention, a method of treating or preventing a prostaglandin mediated disease is described which is further comprised of administering to said patient an effective amount of a COX-2 selective inhibiting compound.

More particularly, a method of treating or preventing a
 30 prostaglandin mediated disease is addressed wherein the prostaglandin mediated disease is selected from the group consisting of:

pain, fever, inflammation, rheumatic fever, symptoms associated with influenza or other viral infections, common cold, low back and neck pain, skeletal pain, post-partum pain, dysmenorrhea,
 35 headache, migraine, toothache, sprains, strains, myositis, neuralgia, synovitis, arthritis including rheumatoid arthritis, degenerative joint diseases (osteoarthritis), gout, ankylosing spondylitis, bursitis, burns including radiation and corrosive chemical injuries, sunburns, pain following surgical and dental procedures, immune and autoimmune
 40 diseases, cellular neoplastic transformations, metastatic tumor growth, prostaglandin-mediated proliferation disorders such as diabetic

5 retinopathy and tumor angiogenesis, dysmenorrhea, premature labor, asthma, eosinophil related disorders, Alzheimer's disease, glaucoma, bone loss (osteoporosis), promotion of bone formation (treatment of fractures) and other bone diseases such as Paget's disease.

Further, a method of treating or preventing an E type
10 prostaglandin mediated disease in a mammalian patient is described herein, comprising administering to said patient an amount of an E type prostaglandin ligand in an amount which is effective to treat or prevent said E type prostaglandin mediated disease.

More particularly, the method described with respect to E-
15 typ prostaglandin mediated diseases further comprises administering a COX-2 selective inhibitor.

Examples of COX-2 selective compounds are such as those described in the following patents and published applications:
WO96/25405, U.S.Pat. No. 5,633,272, WO97/38986, U. S. Pat. No. 5,466,823,
20 WO98/03484, WO97/14691 and WO95/00501.

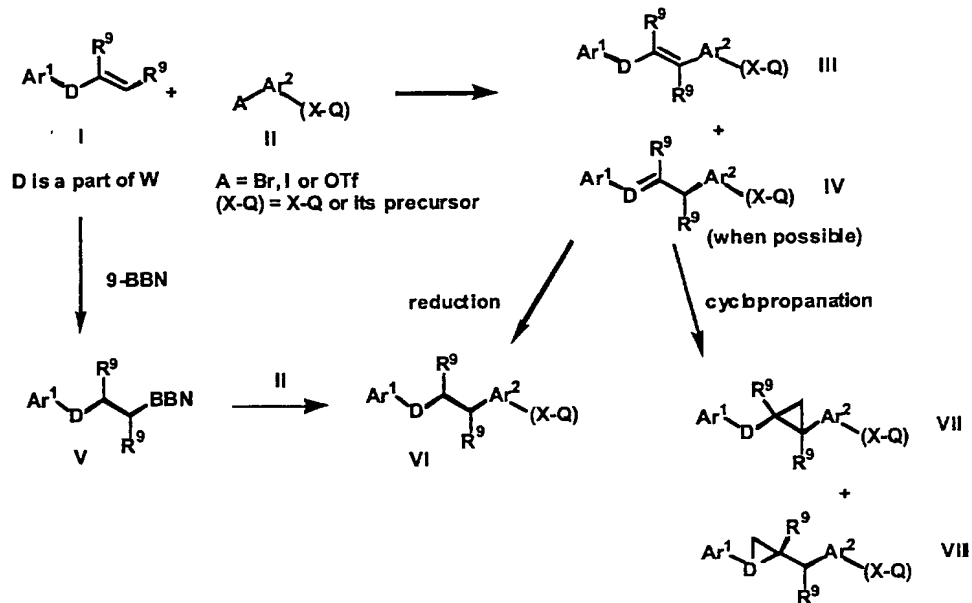
METHODS OF SYNTHESIS

Compounds of the present invention can be prepared according to the following methods. Methods A, I and J showed how to
25 form the linker W between Ar¹ and Ar²; methods B and E - H concentrate on linker X; method C explained how to obtain sulfonamides and method D illustrate how to substitute Ar¹. One particular method is usually used in conjunction with other methods to yield compounds of formula II. Reagents given below are for illustration of the chemistry only and
30 should not be limiting this patent: other reagents might be as effective or better for each reaction described.

Method A

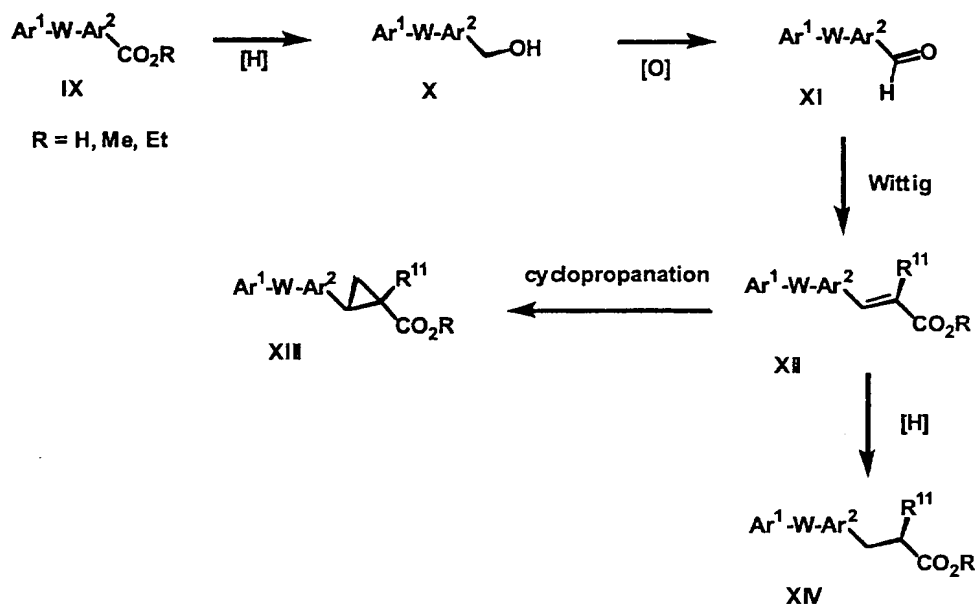
An aryl alkene I can be coupled with an aryl bromide,
35 iodide or triflate II in the presence of a catalyst such as Pd(OAc)₂ to give the two isomers III and IV. Catalytic hydrogenation of the double bond, using Pd/C or (Ph₃P)₃RhCl, yield the compound VI. Alternatively, VI can be prepared from I via formation of the boronate V with 9-borabicyclo[3.3.1]nonane and coupling with II in the presence of a
40 catalyst such as PdCl₂(dppf). Cyclopropanation of the alkenes III and IV can be performed using conditions such as CH₂N₂/PdOAc₂ to give VII and VIII. The group X-Q in compounds III, IV, VI, VII and VIII can

- 5 then be transformed to another X-Q group to afford other substructures of II.



Method B

- 10 The acid or esters IX can be reduced to the alcohol X using reagents such as diisobutylaluminum hydride or sodium borohydride. Oxidation to the aldehyde XI can be performed using MnO_2 or pyridinium chlorochromate. Wittig reaction on XI afford the propenoate XII which can be cyclopropanated ($\text{CH}_2\text{N}_2/\text{Pd}(\text{OAc})_2$) to XIII or reduced
- 15 ($\text{H}_2/\text{Pd/C}$) to XIV. When R = H, compounds IX, XII, XIII and XIV are substructures of II.

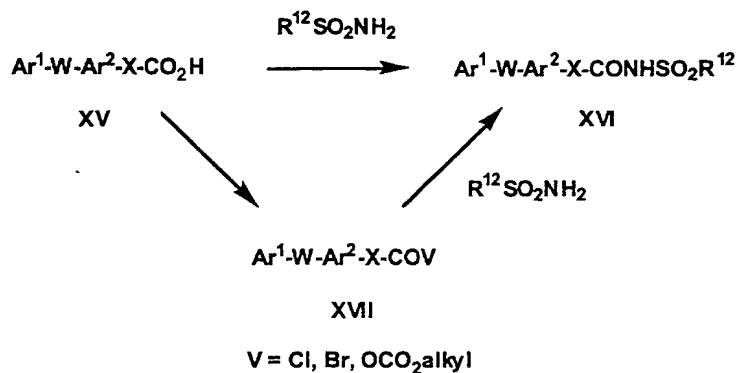


5

Method C

The acid XV, which is a substructure of II, can be transformed to the sulfonamide XVI, another substructure of II, by treatment with a sulfonamide in the presence of a coupling reagent such as 1-(3-dimethylaminopropyl)-3-ethylcarbodiimide. Another method for the preparation of XVI involves the formation of an acid chloride or a mixed anhydride XVII and reaction with the sulfonamide in the presence of a base such as Et₃N.

10

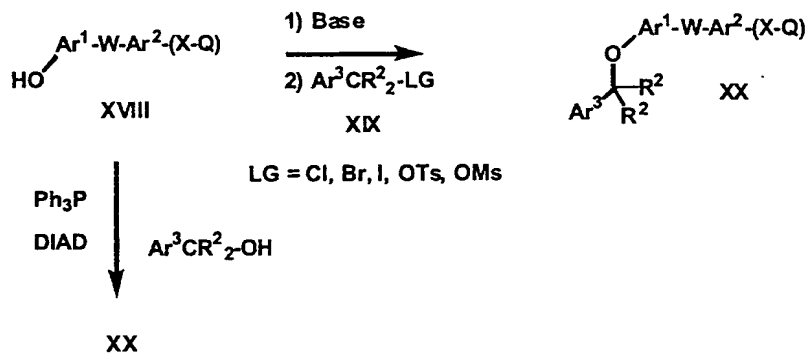


15

Method D

When compound II or its precursor is substituted by an hydroxyl group as in XVIII, it can be alkylated by a reagent containing a

- 5 leaving group XIX in the presence of a base such as NaH or DBU to yield the ether XX. Alternatively, Mitsunobu reaction with the alcohol derivative of XIX also yield XX. The group X-Q in XX can then be transformed to another X-Q group to afford another example of II.

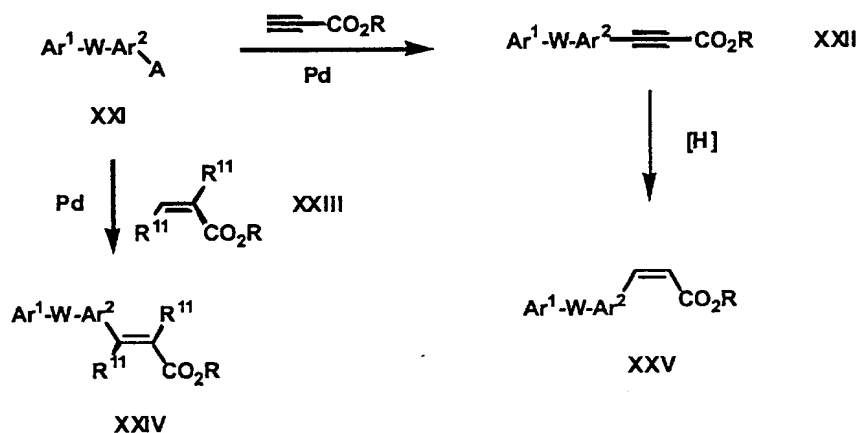


10

Method E

- 15 The aryl bromide, iodide or triflate XXI can be coupled with an alkyne or the alkene XXIII in the presence of a catalyst such as Pd(OAc)₂ (J. Org. Chem. 1979, 4078) to give the products XXII or XXIV respectively. Catalytic hydrogenation of the alkyne XXII over Lindlar's catalyst can afford the cis alkene XXV. When R = H, compounds XXII, XXIV and XXV are substructures of II and they can be treated as in method B to yield other examples of II.

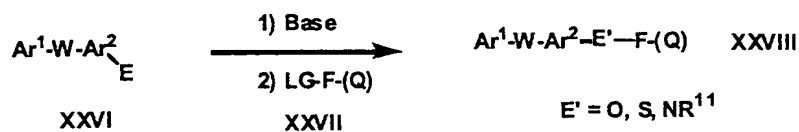
20



Method F

- 25 An aryl thiol, alcohol or amine XXVI can be treated with a base and then with reagent XXVII to yield the derivative XXVIII. The

- 5 group E'-F-Q can be transformed to another E'-F-Q group using the other methods described here and yield examples of II possessing an heteroatom attached to Ar² in the linker X.



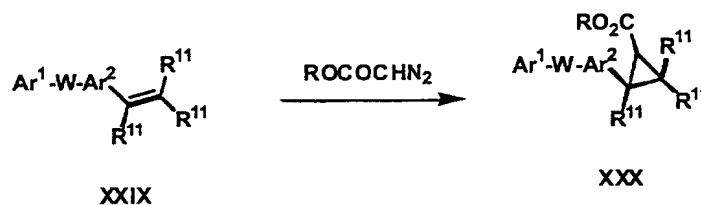
E = OH, SH, NHR¹¹

F is a part of X
(Q) is Q or its precursor

10

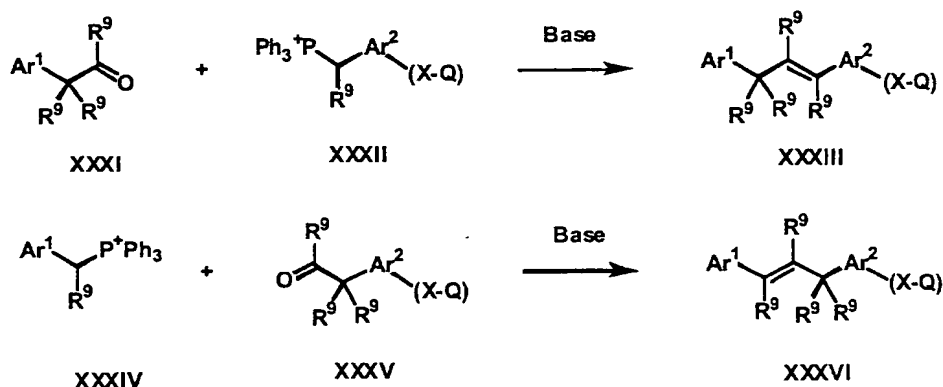
Method G

Compounds II possessing a cyclopropane unit as an X group XXX can be synthesized via a reaction between the alkene XXIX and a diazoacetate in the presence of a catalyst such as rhodium acetate dimer.



Method H

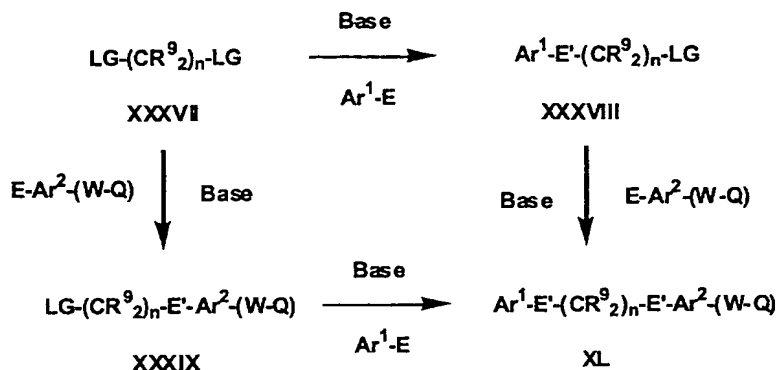
- 20 Compounds II possessing a double bond as part of the linker X can be synthesized via a Wittig reaction as exemplified in the next scheme. Phosphonium salts XXXII and XXXIV can be obtained from the corresponding Ar-CHR⁹-LG by reaction with Ph₃P.



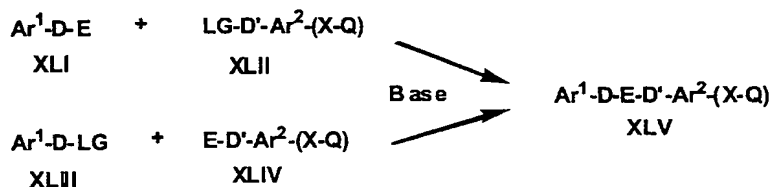
25

5 Method I

Compounds II possessing two heteroatoms as part of the linker W as in XL can be synthesized from a reagent containing two leaving groups XXXVII and two aromatics compounds containing an alcohol, an amine or a thiol function E as described in the following scheme.

Method J

Compounds II possessing one heteroatom as part of the linker W as in XLV can be synthesized from a reagent containing one leaving group XLII or XLIII and an aromatic compound containing an alcohol, an amine or a thiol function E (XLI or XLIV) as described in the following two equations.



D and D' are part of W

ASSAYS FOR DETERMINING BIOLOGICAL ACTIVITY

The compound of Formula II can be tested using the following assays to determine their prostanoïd antagonist or agonist activity *in vitro* and *in vivo* and their selectivity. The prostaglandin receptors investigated were DP, EP₁, EP₂, EP₃, EP₄, FP, IP and TP.

5 Stable expression of prostanoid receptors in the human embryonic kidney (HEK) 293(ebna) cell line

Prostanoid receptor cDNAs corresponding to full length coding sequences were subcloned into the appropriate sites of mammalian expression vectors and transfected into HEK 293(ebna) cells. HEK 293(ebna) cells expressing the individual cDNAs were grown under selection and individual colonies were isolated after 2-3 weeks of growth using the cloning ring method and subsequently expanded into clonal cell lines.

15 Prostanoid receptor binding assays

HEK 293(ebna) cells are maintained in culture, harvested and membranes are prepared by differential centrifugation, following lysis of the cells in the presence of protease inhibitors, for use in receptor binding assays. Prostanoid receptor binding assays are performed in 10 mM MES/KOH (pH 6.0) (EPs, FP and TP) or 10 mM HEPES/KOH (pH 7.4) (DP and IP), containing 1 mM EDTA, 10 mM divalent cation and the appropriate radioligand. The reaction is initiated by addition of membrane protein. Ligands are added in dimethylsulfoxide which is kept constant at 1 % (v/v) in all incubations. Non-specific binding is determined in the presence of 1 μ M of the corresponding non-radioactive prostanoid. Incubations are conducted for 60 min at room temperature or 30 °C and terminated by rapid filtration. Specific binding is calculated by subtracting non specific binding from total binding. The residual specific binding at each ligand concentration is calculated and expressed as a function of ligand concentration in order to construct sigmoidal concentration-response curves for determination of ligand affinity.

Prostanoid receptor agonist and antagonist assays

Whole cell second messenger assays measuring stimulation (EP₂, EP₄, DP and IP in HEK 293(ebna) cells) or inhibition (EP₃ in human erythroleukemia (HEL) cells) of intracellular cAMP accumulation or mobilization of intracellular calcium (EP₁, FP and TP in HEK 293(ebna) cells stably transfected with apo-aequorin) are performed to determine whether receptor ligands are agonists or antagonists. For cAMP assays, cells are harvested and resuspended in

- 5 HBSS containing 25 mM HEPES, pH 7.4. Incubations contain 100 μ M RO-20174 (phosphodiesterase type IV inhibitor, available from Biomol) and, in the case of the EP₃ inhibition assay only, 15 μ M forskolin to stimulate cAMP production. Samples are incubated at 37°C for 10 min, the reaction is terminated and cAMP levels are then measured. For
- 10 calcium mobilization assays, cells are charged with the co-factors reduced glutathione and coelenterazine, harvested and resuspended in Ham's F12 medium. Calcium mobilization is measured by monitoring luminescence provoked by calcium binding to the intracellular photoprotein aequorin. Ligands are added in dimethylsulfoxide which is
- 15 kept constant at 1 % (v/v) in all incubations. For agonists, second messenger responses are expressed as a function of ligand concentration and both EC₅₀ values and the maximum response as compared to a prostanoid standard are calculated. For antagonists, the ability of a ligand to inhibit an agonist response is determined by Schild
- 20 analysis and both K_b and slope values are calculated.

Rat Paw Edema Assay

The method is the same as described in Chan *et al* (J. Pharmacol. Exp. Ther. 274: 1531-1537, (1995)).

LPS-Induced Pyrexia in Conscious Rats

The method is the same as described in Chan *et al* (J. Pharmacol. Exp. Ther. 274: 1531-1537, (1995)).

LPS-Induced Pyrexia in Conscious Squirrel Monkeys

The method is the same as described in Chan *et al* (Eur. J. Pharmacol. 327: 221- 225, (1997)).

Acute Inflammatory Hyperalgesia Induced by Carrageenan in Rats

The method is the same as described in Boyce *et al* (Neuropharmacology 33: 1609-1611, (1994)).

Adjuvant-Induced Arthritis in Rats

Female Lewis rats (body weight ~146-170 g) were weighed, ear marked, and assigned to groups (a negative control group in which arthritis was not induced, a vehicle control group, a positive control group administered indomethacin at a total daily dose of 1 mg/kg and four groups administered with a test compound at total daily doses of

5 0.10-3.0 mg/kg) such that the body weights were equivalent within each group. Six groups of 10 rats each were injected into a hind paw with 0.5 mg of *Mycobacterium butyricum* in 0.1 mL of light mineral oil (adjuvant), and a negative control group of 10 rats was not injected with adjuvant. Body weights, contralateral paw volumes (determined by
10 mercury displacement plethysmography) and lateral radiographs (obtained under Ketamine and Xylazine anesthesia) were determined before (day -1) and 21 days following adjuvant injection, and primary paw volumes were determined before (day -1) and on days 4 and 21 following adjuvant injection. The rats were anesthetized with an
15 intramuscular injection of 0.03 - 0.1 mL of a combination of Ketamine (87 mg/kg) and Xylazine (13 mg/kg) for radiographs and injection of adjuvant. The radiographs were made of both hind paws on day 0 and day 21 using the Faxitron (45 kVp, 30 seconds) and Kodak X-OMAT TL film, and were developed in an automatic processor. Radiographs were
20 evaluated for changes in the soft and hard tissues by an investigator who was blinded to experimental treatment. The following radiographic changes were graded numerically according to severity: increased soft issue volume (0-4), narrowing or widening of joint spaces (0-5) subchondral erosion (0-3), periosteal reaction (0-4), osteolysis (0-4)
25 subluxation (0-3), and degenerative joint changes (0-3). Specific criteria were used to establish the numerical grade of severity for each radiographic change. The maximum possible score per foot was 26. A test compound at total daily doses of 0.1, 0.3, 1, and 3 mg/kg/day, indomethacin at a total daily dose of 1 mg/kg/day, or vehicle (0.5%
30 methocel in sterile water) were administered per os b.i.d. beginning post injection of adjuvant and continuing for 21 days. The compounds were prepared weekly, refrigerated in the dark until used, and vortex mixed immediately prior to administration.

35 EXAMPLES

The invention is further illustrated in the following non-limiting examples in which, unless otherwise stated:

yields are given for illustration only and are not necessarily the maximum attainable;

40 all the end products of the formula II were analyzed by NMR, TLC and mass spectrometry;

5 intermediates were all analyzed by NMR and TLC;
 most compounds were purified by flash chromatography on silica gel,
 recrystallization and/or swish (suspension in a solvent followed by
 filtration of the solid) with a solvent such as ether:hexane 1:1;
 the course of reactions was followed by thin layer
 10 chromatography (TLC) and reaction times are given for illustration
 only;
 temperatures are in degrees Celsius.

EXAMPLE 1

15 3-(2-(3-(2-(BENZYLOXY)-3-
METHYLPHENYL)PROPYL)PHENYL)PROPANOIC ACID

A mixture of the products of examples 28 and 29 was
 dissolved in 2 ml MeOH:EtOAc 1:1 with
tris(triphenylphosphine)rhodium(I) chloride (2mg) and the mixture
 20 hydrogenated under 60 psi of H₂. The reaction was followed by mass
 spectroscopy and, when completed, the solvent was evaporated and the
 product purified by flash chromatography with EtOAc:toluene
 containing 1% AcOH.

25 MS (APCI, neg.) 387.2 (M-1), 279.2.

EXAMPLES 2 AND 3

N2-((E)-3-(2-((E)-3-(2-(BENZYLOXY)-3-METHYLPHENYL)-1-
 PROPENYL)PHENYL)-2-PROPENOYL)-2-
 THIOPHENESULFONAMIDE

30 AND
 N2-((E)-3-(2-((E)-3-(2-(BENZYLOXY)-3-METHYLPHENYL)-2-
PROPENYL)PHENYL)-2-PROPENOYL)-2-
THIOPHENESULFONAMIDE

35 These acylsulfonamides were prepared from the cinnamic
 acids of examples 28 and 29 following the procedure of examples 44 and
 45.

MS (APCI, neg.) 528.2 (M-1).

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5

EXAMPLES 6 AND 7

SODIUM (E)-3-(2-((E)-3-(2-(BENZYLOXY)PHENYL)-1-
PROPENYL)PHENYL)-2-PROPENOATE

AND

10 SODIUM (E)-3-(2-((E)-3-(2-(BENZYLOXY)PHENYL)-2-
PROPENYL)PHENYL)-2-PROPENOATE

Step 1 1-allyl-2-(benzyloxy)benzene

Sodium hydride 80% in oil (800 mg, 1.2 equiv.) was added to
a solution of 2-allylphenol (2.998 g, 22 mmol) in DMF (40 ml) at 0°C and
15 the mixture was stirred at 0°C for 15 min. and at r.t. for 1 h. Benzyl
bromide (2.9 ml, 1.1 equiv.) was then added and the stirring was
continued for 1 h. After hydrolysis with saturated NH₄Cl, the product
was extracted in EtOAc, dried over Na₂SO₄, and concentrated to yield
5.01 g of an oil (yield 100%).

20 ¹H NMR (Acetone-d₆) δ 3.40 (2H, d), 4.95 - 5.08 (2H, m), 5.13
(2H, s), 6.00 (1H, m), 6.90 (1H, dd), 7.03 (1H, d), 7.18 (2H, m), 7.32 (1H, m),
7.40 (2H, dd), 7.50 (2H, d).

25 Step 2 (E)-3-(2-((E)-3-(2-(benzyloxy)phenyl)-1-propenyl)phenyl)-2-
propenoic acid and (E)-3-(2-((E)-3-(2-(benzyloxy)phenyl)-2-
propenyl)phenyl)-2-propenoic acid

A mixture containing 2-bromocinnamic acid (250 mg, 1.10
mmol), the product of step 1 (271 mg, 1.1 equiv.), Pd(OAc)₂ (8 mg, 0.03
equiv.), LiCl (47 mg, 1 equiv.), LiOAc (280 mg, 2.5 equiv.) and Bu₄NCl
30 (611 mg, 2 equiv.) in DMF (2 ml) was degassed and heated to 100°C
o.n.. 0.5 N HCl was then added and the product was extracted in EtOAc,
washed with 0.5 N HCl, dried over Na₂SO₄ and concentrated to dryness.
Recrystallization from ether:hexane afforded the title product as a white
solid. Yield: 251 mg, 62%.

35 ¹H NMR (Acetone-d₆) δ 3.68 and 3.74 (2H, 2d), 5.10 and 5.20
(2H, 2s), 6.30 - 6.53 (2H, m), 6.70 - 6.93 (2H, m), 7.03 (1H, 2d), 7.18 (1H, m),
7.25 - 7.43 (7H, m), 7.50 (2H, m), 7.68 and 7.77 (1H, 2d), 8.03 (1H, 2d).

Step 3

40 The acids of step 2 were dissolved in EtOH and 1.0 equiv. of
NaOH 1.0 N was added. The solvent was evaporated, the oil dissolved in
water and the products were freeze-dried to afford a white solid.

5 MS (APCI, neg.) 369.0 (M-1)

The products of the following examples have been prepared in a manner similar to examples 6 and 7 and are mixtures of 2 compounds each.

10

Examples	Note	MS (APCI, neg.) ^c
8 & 9		429.1
10 & 11	d	411.2
12 & 13		399.1
14 & 15		399.1
16 & 17	a	371.1, 327.2 (M-CO ₂ H)
18 & 19	a	405.2, 361.0 (M-CO ₂ H)
21 & 22	d	443.1
23 & 24	d	307.1
25 & 26	d	263.1, 219.1 (M-CO ₂ H)
28 & 29	b	383.2
38 & 39	d	293.1, 234.0
40 & 41	d	323.1, 264.1
72 & 73		368.9, 233.2

a) Pd coupling (step 2) at 120°C o.n.,

b) the two products were separated by HPLC on a NovaPak C18 column,

c) M-1

15 d) the sodium salt was not prepared

EXAMPLE 20

2-(2-(3-(4-(BENZYLOXY)-3-

METHOXYPHENYL)PROPYL)PHENYL)CYCLOPROPANE

20

CARBOXYLIC ACID

Step 1 (E)-2-(2-(3-(4-(benzyloxy)-3-methoxyphenyl)propyl)phenyl)-2-propenoic acid

25 A solution of 9-borabicyclo[3.3.1]nonane 0.5 M in THF (3.8 ml, 1.5 equiv.) was added slowly to 4-allyl-1-benzyloxy-2-methoxybenzene (257 mg, 1.21 mmol, prepared as in examples 6 and 7, step 1) and the mixture was stirred at r.t. for 30 min. K₃PO₄ (384 mg), 2-bromocinnamic acid (222 mg, 978 mmol), (1,1'-bis(diphenylphosphino)ferrocene) dichloropalladium(II) (31 mg) and DMF (4 ml) were added and the
30 mixture was degassed and stirred at 50°C o.n.. A saturated solution of

- 5 NH_4Cl was added, the solution was acidified with AcOH and the product was extracted in EtOAc, dried over Na_2SO_4 and partially purified by flash chromatography with EtOAc:toluene:AcOH 5:95:1.

Step 2 Methyl 2-(2-(3-(4-(benzyloxy)-

- 10 3-methoxyphenyl)propyl)phenyl)cyclopropane-carboxylate

The acid of step 1 was treated with diazomethane in ether at reflux. The solvent was removed and the ester was purified by flash chromatography with EtOAc:toluene 2.5:97.5.

- 15 Step 3

The ester of step 2 was hydrolyzed with NaOH as in example 61, step 3. The final product was purified by HPLC with EtOAc:toluene:AcOH 2.5:97.5:1 on a $\mu\text{Porasil}$ column to yield the title cyclopropaneacetic acid.

- 20 ^1H NMR (acetone, d_6) δ 1.43 (2H, m), 1.76 (1H, m), 1.93 (2H, m), 2.55 (1H, m), 2.65 (2H, t), 2.82 (2H, m), 3.80 (3H, s), 5.07 (2H, s), 6.72 (1H, d), 6.87 (1H, s), 6.91 (1H, d), 7.03 (1H, d), 7.08 - 7.22 (3H, m), 7.28 - 7.41 (3H, m), 7.47 (2H, d). MS (APCI, neg.) 415.1 (M-1), 324.3.

- 25

EXAMPLE 27

(E)-3-(2-((E)-3-(2-HYDROXY-3-METHYLPHENYL)-2-PROPENYL)PHENYL)-2-PROPENOIC ACID

- 30 This product was obtained as a mixture with the other isomer (E)-3-(2-((E)-3-(2-hydroxy-3-methylphenyl)-1-propenyl)phenyl)-2-propenoic acid via a palladium coupling between 2-bromocinnamic acid and 2-alkyl-6-methylphenol as in examples 6 and 7, step 2. The title acid was separated from the other isomer by recrystallization from ether:hexane 1:1. Yield of pure product: 48%.

- 35 ^1H NMR (Acetone- d_6) δ 2.20 (3H, s), 3.74 (2H, d), 6.34 ((1H, m), 6.44 (1H, d), 6.70 (1H, t), 6.80 (1H, d), 6.95 (1H, d), 7.22 (1H, d), 7.30 (1H, t), 7.35 (2H, m), 7.74 (1H, d), 8.10 (1H, d).

5

EXAMPLES 30 AND 31

(E)-3-(2-((E)-3-(2-((7-CHLORO-2-QUINOLINYL)METHOXY)-3-METHYLPHENYL)-1-PROPENYL)PHENYL)-2-PROPENOIC ACID
AND (E)-3-(2-((E)-3-(2-((7-CHLORO-2-QUINOLINYL)METHOXY)-3-METHYLPHENYL)-2-PROPENYL)PHENYL)-2-PROPENOIC ACID

10

Step 1 Methyl (E)-3-(2-((E)-3-(2-hydroxy-3-methylphenyl)-2-propenyl)phenyl)-1-propenyl)phenyl)-2-propenoate and methyl (E)-3-(2-((E)-3-(2-hydroxy-3-methylphenyl)-2-propenyl)phenyl)-2-propenyl)phenyl)-2-propenoate

15

These two products were prepared as a mixture via esterification of the two acids in example 27 using the procedure of example 61, step 1.

Step 2

20

Treatment of the two esters of step 1 with 7-chloro-2-(bromomethyl)quinoline (obtained by bromination of 7-chloroquinoline with N-bromosuccinimide) and hydrolysis of the esters was performed as in example 61, steps 2 and 3.

MS (APCI, neg.) 470.0, 468.0 (M-1).

25

EXAMPLE 32

2-(3-(2-BENZYLOXY-3-METHYLPHENYL)PROPYL)BENZOIC ACID

3-Allyl-2-(benzyloxy)toluene (prepared as in examples 6 and 7, step 1) was treated with 9-BBN and then with ethyl 2-bromobenzoate as in example 20, step 1, to give the ester of the title compound. This ester was hydrolyzed as in example 61, step 3.

30

¹H NMR (acetone d₆) δ 1.95 (2H, m), 2.30 (3H, s), 2.75 (2H, m), 3.08 (2H, dd), 4.70 (2H, s), 6.92 - 7.12 (3H, m), 7.24 - 7.53 (8H, m), 7.93 (1H, d).

35

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5

EXAMPLES 33 AND 34

SODIUM 2-(3-(2-BENZYLOXY-3-METHYLPHENYL)-1-
PROPENYL)BENZOATE AND SODIUM 2-(3-(2-BENZYLOXY-3-
METHYLPHENYL)-2-PROPENYL)BENZOATE

3-allyl-2-(benzyloxy)toluene (prepared as in examples 6 and
7, step 1) was coupled to ethyl 2-bromobenzoate as in examples 6 and 7,
step 2. The resulting ester was hydrolyzed as in example 61, step 3.

¹H NMR (acetone d₆) δ 2.25 and 2.32 (3H, 2s), 3.64 and 3.97
(2H, 2d), 4.76 and 4.93 (2H, 2s), 6.33 and 6.50 (1H, 2td), 6.68 - 7.64 (12H,
m), 7.90 and 7.98 (1H, 2d).

The sodium salts were prepared as in examples 6 and 7,
step 3.

EXAMPLE 35

SODIUM (E)-3-(2-(3-(2-BENZYLOXY-3-
METHYLPHENYL)PROPYL)PHENYL)-2-PROPENOATE

Step 1 2-(3-(2-benzyloxy-3-methylphenyl)propyl)benzaldehyde

3-allyl-2-(benzyloxy)toluene was treated with 9-BBN and
then with 2-bromobenzaldehyde as in example 20, step 1, to give the title
aldehyde. Yield 58%.

Step 2 Ethyl (E)-3-(2-(3-(2-benzyloxy-3-methylphenyl)propyl)phenyl)-2-
propenoate

To the aldehyde of step 1 (850 mg, 2.47 mmol) was added
(methoxycarbonylmethylene)triphenylphosphorane (1.24 g, 1.5 equiv.)
and the mixture was heated to 80°C in 25 ml of toluene for 10 h.
NH₄Cl was added and the mixture was extracted in EtOAc, dried over
Na₂SO₄ and the product was purified by flash chromatography with
EtOAc:toluene 2.5:97.5. Yield: 770 mg, 78%.

Step 3

Hydrolysis of the ester was performed as in example 61, step
3.

MS (APCI, neg.) 385.1 (M-1).

The sodium salt was prepared as in examples 6 and 7, step
3.

- 5 The products of the following table were prepared in a manner similar to example 34.

Example #	MS (APCI, neg.)
36	401.2 (M-1), 310.0
37	401.2 (M-1), 310.0

EXAMPLE 42

- 10 SODIUM (E)-3-(2-((E)-3-(2-(BENZYLOXY)PHENYL)-3-HYDROXY-1-PROPENYL)PHENYL)-2-PROPENOATE

Step 1 1-(2-(benzyloxy)phenyl)-2-propen-1-ol

- 15 2-(benzyloxy)benzaldehyde (5g, 23.6 mmol) was reacted with vinylmagnesium bromide in THF (90 ml) at 0°C. The reaction was quenched with 2 N HCl and the product was extracted in i-PrOAc, dried over Na₂SO₄ and purified by flash chromatography with EtOAc:toluene 2.5:97.5.

20 Step 2

- A mixture containing the allylic alcohol of step 1 (298 mg, 1.24 mmol), 2-bromocinnamic acid (299 mg, 1.06 equiv.), Bu₄NOAc (380 mg, 1 equiv.), Et₃N (1.2 ml), PdCl₂(Ph₃P)₂ (26 mg, 0.03 equiv.) and DMF (5 ml) was degassed and heated to 100°C for 2 h. After addition of NH₄Cl
25 and acidification with AcOH, the product was extracted in EtOAc, dried over Na₂SO₄ and purified by flash chromatography with EtOAc:toluene:AcOH 10:90:5. Yield: 239 mg, 50%.

MS (APCI, neg.) 385.1 (M-1), 235.0

The sodium salt was prepared as in examples 6 and 7, step

- 30 3.

EXAMPLE 43

- 35 N2-((E)-3-(2-(3-(2-(BENZYLOXY)-3-METHYLPHENYL)PROPYL)PHENYL)-2-PROPANOYL)-2-THIOPHENESULFONAMIDE, SODIUM SALT

The mixture of the two acylsulfonamides of examples 2 and 3 were reduced by catalytic hydrogenation using 10% Pd/C in EtOAc at atmospheric pressure for 3 days. Filtration through celite and purification by flash chromatography yielded the title sulfonamide.

5 ¹H NMR (Acetone-d₆) δ 1.85 (2H, m), 2.30 (3H, s), 2.60 (4H, m), 2.71 (2H, t), 2.85 (2H, t), 4.70 (2H, s), 6.92 - 7.13 (7H, m), 7.20 (1H, dd), 7.30 - 7.50 (5H, m), 7.80 (1H, d), 7.95 (1H, d). MS (APCI, neg.) 531.9 (M-1).

The sodium salt was prepared as in examples 6 and 7, step 3.

EXAMPLES 44 AND 45

N2-((E)-3-(2-((E)-3-(4-(BENZYLOXY)-3-METHOXYPHENYL)-1-PROPENYL)PHENYL)-2-PROPENOYL)-2-THIOPHENESULFONAMIDE AND N2-((E)-3-(2-((E)-3-(4-(BENZYLOXY)-3-METHOXYPHENYL)-2-PROPENYL)PHENYL)-2-PROPENOYL)-2-THIOPHENE SULFONAMIDE, SODIUM SALTS

The product of examples 14 and 15 (254 mg, 634 μmol) was dissolved in 6 ml CH₂Cl₂. DMF (10 μl) and oxalyl chloride (76 ml, 1.4 equiv.) were then added at 0°C and the solution was stirred at r.t. for 1.5 h. The solvent was evaporated and the resulting acid chloride was redissolved in CH₂Cl₂ (6 ml). At 0°C, 2-thiophenesulfonamide (124 mg, 1.2 equiv.) and Et₃N (177 μl, 2 equiv.) were added and the mixture was stirred at 0°C for 1 h. 0.5 N HCl was then added and the product was extracted in i-PrOAc, dried over Na₂SO₄ and purified by flash chromatography on silica using EtOAc:toluene:AcOH 20:80:1. Yield: 201 mg, 58%.

MS (APCI, neg.) 544.2 (M-1).

The sodium salts were prepared as in examples 6 and 7, step 3.

5

EXAMPLE 46 AND 47

SODIUM (E)-3-(2-((2-(2-(BENZYLOXY)-3-METHYLPHENYL)CYCLOPROPYL)METHYL)PHENYL)-2-PROPENOATE AND SODIUM (E)-3-(2-(2-((2-(BENZYLOXY)-3-METHYLPHENYL)METHYL)CYCLOPROPYL)PHENYL)-2-PROPENOATE

10

Step 1 Ethyl 2-((2-(2-(benzyloxy)-3-methylphenyl)cyclopropyl)methyl)benzoate and ethyl 2-((2-(2-(benzyloxy)-3-methylphenyl)methyl)cyclopropyl)benzoate

15

The intermediate ester of example 33 was treated with portions of CH_2N_2 solution in ether and $\text{Pd}(\text{OAc})_2$ alternatively and at 0°C until the reaction was complete. AcOH was added and the mixture was filtered through silica with ether and concentrated. This product was used as such in the next step.

20

Step 2 2-((2-(2-(benzyloxy)-3-methylphenyl)cyclopropyl)methyl)benzaldehyde and 2-((2-(2-(benzyloxy)-3-methylphenyl)methyl)cyclopropyl)benzaldehyde

25

To a solution of the ester of step 1 (3.68 mmol) in THF (20 ml) was added diisobutylaluminum hydride 1.0 M in toluene (16 ml, 4.4 equiv.) at -72°C and the mixture was stirred at -40°C for 10 min. The reaction was quenched with sodium potassium tartrate 1.0 M and was stirred at r.t. for 1.5 h. It was neutralized with AcOH and extracted in i-PrOAc. The product was dried over Na_2SO_4 and concentrated.

30

This benzylic alcohol was oxidized with activated MnO_2 (20 equiv.) in EtOAc at r.t. o.n. The mixture was then filtered through celite, concentrated and the aldehyde was purified by flash chromatography with toluene. Yield: 83% for steps 1 and 2.

35 Step 3

The aldehyde of step 2 was treated as in Example 34, steps 2 and 3, to afford the two title products. The sodium salts were prepared as in examples 6 and 7, step 3.

MS (APCI, neg.) 397.1 (M-1).

40

5

EXAMPLE 48

SODIUM (E)-3-(2-((E)-3-(2-BENZYLOXY-3-METHYLPHENYL)-3-
HYDROXY-1-PROPENYL)PHENYL)-2-PROPENOATE

10 Step 1 Methyl (E)-3-(2-((E)-3-(2-benzyloxy-3-methylphenyl)-3-acetoxy-1-
propenyl)phenyl)-2-propenoate and methyl (E)-3-(2-((E)-3-(2-benzyloxy-3-
methylphenyl)-1-acetoxy-2-propenyl)phenyl)-2-propenoate.

15 The two products of examples 28 and 29 were esterified with NaH and MeI as in example 61, step 1. These esters (928 mg, 2.33 mmol) were heated to reflux in AcOH (15 ml) with SeO₂ (310 mg, 1.2 equiv.) for 15 min. After neutralization with NaHCO₃, the products were extracted in EtOAc, dried over Na₂SO₄ and purified by flash chromatography with EtOAc:toluene 5:95.

20 Step 2 Methyl (E)-3-(2-((E)-3-(2-benzyloxy-3-methylphenyl)-3-hydroxy-1-
propenyl)phenyl)-2-propenoate

25 The product of step 1 (2.3 mmol) was treated with 1.8-diazabicyclo[5.4.0]undec-7-ene (3 drops) in MeOH (10 ml) for 2 h. After evaporation, the title product was separated from the less polar cyclized isomer (methyl 2-(3-((E)-2-(2-(benzyloxy)-3-methylphenyl)-1-ethenyl)-1,3-dihydro-1-isobenzofuranyl)acetate) by flash chromatography with EtOAc:toluene 2.5:97.5 and 5:95.

Step 3

30 Hydrolysis was performed as in example 61, step 3. The sodium salt was prepared as in examples 6 and 7, step 3. MS (APCI, neg.) 399.1 (M-1), 249.0.

60103554, 100798

5

EXAMPLES 50 AND 51

(E)-3-(2-((E)-3-(2-(2,6-DICHLOROBENZYLOXY)-3-METHYLPHENYL)-3-HYDROXY-1-PROPENYL)PHENYL)-2-PROPENOIC ACID AND (E)-3-(2-((E)-3-(2-(2,6-DICHLOROBENZYLOXY)-3-METHYLPHENYL)-1-HYDROXY-2-PROPENYL)PHENYL)-2-PROPENOIC ACID

10

Step 1 (E)-3-(2-((E)-3-(2-(2,6-dichlorobenzoyloxy)-3-methylphenyl)-3-acetoxy-1-propenyl)phenyl)-2-propenoic acid and (E)-3-(2-((E)-3-(2-(2,6-dichlorobenzoyloxy)-3-methylphenyl)-1-acetoxy-2-propenyl)phenyl)-2-propenoic acid

15

The product of example 61 was treated with SeO_2 in AcOH as in example 48, step 1 to afford the two title acetates. Yield: 92%.

Step 2

The two acetates of step 1 (153 mg, 282 μmol) were heated in AcOH:H₂O 1:1 (14 ml) at 105°C for 45 min. After addition of NH_4Cl , the products were extracted in EtOAc, dried over Na_2SO_4 and purified by flash chromatography with EtOAc:toluene:AcOH 10:90:1. The two products were separated by HPLC on a NovaPak C18 cartridge using MeOH:(1:1 AcOH:AcONa 2 g/L) 7:3 and UV detection at 280 nm.

The more polar product was (E)-3-(2-((E)-3-(2-(2,6-dichlorobenzoyloxy)-3-methylphenyl)-1-hydroxy-2-propenyl)phenyl)-2-propenoic acid. Yield: 28 mg.

^1H NMR (acetone d_6) δ 2.10 (3H, s), 5.20 (2H, s), 5.73 (1H, d), 6.20 (1H, d), 6.47 (1H, dd), 6.97 (1H, t), 7.04 (1H, d), 7.10 (1H, d), 7.37 - 7.48 (6H, m), 7.63 (1H, d), 7.72 (1H, d), 8.35 (1H, d). MS (APCI, neg.) decomposition.

The less polar isomer was (E)-3-(2-((E)-3-(2-(2,6-dichlorobenzoyloxy)-3-methylphenyl)-3-hydroxy-1-propenyl)phenyl)-2-propenoic acid.

Yield: 17 mg.

35

MS (APCI, neg.) 467.0 (M-1), 291.0.

5

EXAMPLE 58 AND 59

(E)-3-(2-((E)-3-(2-(2,6-DICHLOROBENZYLOXY)-3-(HYDROXYMETHYL)PHENYL)-1-PROPENYL)PHENYL)-2-PROPENOIC ACID AND (E)-3-(2-((E)-3-(2-(2,6-DICHLOROBENZYLOXY)-3-(HYDROXYMETHYL)PHENYL)-2-PROPENYL)PHENYL)-2-PROPENOIC ACID

10

Step 1 3-allyl-2-(2,6-dichlorobenzoyloxy)benzaldehyde

2-(allyloxy)benzaldehyde (2.00 g, 12.33 mmol) was heated in o-dichlorobenzene (20 ml) at reflux o.n. The mixture was poured on top of a flash chromatography column and eluted with toluene:hexane 1:1.

Yield: 1.346 g, 67%.

Step 2

20

The phenol of step 1 was treated with NaH and 2,6-dichlorobenzyl bromide as in examples 6 and 7, step 1, to give the benzyl ether. Then, the aldehyde was reduced with diisobutylaluminum hydride in THF at -10°C for 15 min. (see examples 46 and 47, step 2). Finally, a palladium coupling with 2-bromocinnamic acid was performed as in examples 6 and 7, step 2, to give the two title isomers.

25

Overall yield: 65%.

MS(APCI, neg.) 467.1 (M-1), 291.1.

EXAMPLE 61

30

SODIUM (E)-3-(2-((E)-3-(2-(2,6-DICHLOROBENZYLOXY)-3-METHYLPHENYL)-2-PROPENYL)PHENYL)-2-PROPENOATE

Step 1 Methyl (E)-3-(2-((E)-3-(2-hydroxy-3-methylphenyl)-2-propenyl)phenyl)-2-propenoate

35

The product of example 27 (2.001 g, 6.80 mmol) was dissolved in DMF (14 ml) and NaH 80% in oil (244 mg, 1.2 equiv.) was added at 0°C. The mixture was stirred for an hour at 0°C, then MeI (635 µl, 1.5 equiv.) was added and the stirring continued for 2 h. After hydrolysis with 0.5 N HCl, the product was extracted in EtOAc and purified by flash chromatography on silica with EtOAc:toluene 2.5:97.5 and 5:95. Yield: 1.70 g, 81%.

40

5

Step 2 Methyl (E)-3-(2-((E)-3-(2-(2,6-dichlorobenzyloxy)-3-methylphenyl)-2-propenyl)phenyl)-2-propenoate

The product of step 1 was treated with NaH and 2,6-dichlorobenzyl bromide as in examples 6 and 7, step 1, to afford the dichlorobenzyl ether.

Step 3

The ester (1.01 g, 2.18 mmol) was hydrolyzed with NaOH 10 N (930 μ l) in THF:MeOH:H₂O 4:2:1 (28 ml) at r.t. o.n.. The reaction was quenched with sat. NH₄Cl, acidified with acetic acid and the product was extracted in EtOAc, concentrated and recrystallized in 20 ml ether:hexane 1:1. Yield: 746 mg, 75%.

The sodium salt was prepared as in examples 6 and 7, step

3.

MS (APCI, neg.) 452.0, 451.0 (M-1), 275.2.

The following compounds were prepared as in example 61.

Example #	MS(APCI, neg.) ^a
28	383.2
53	401.1, 275.2
55	419.1, 275.2
57	419.1, 275.2
63	451.1, 275.2
65	449.1, 275.2

a) M-1.

EXAMPLE 70

SODIUM (E)-3-(2-(3-PHENOXYBENZYLOXYMETHYL)PHENYL)-2-PROPENOATE

Step 1 Ethyl (E)-3-[2-(bromomethyl)phenyl]-2-propenoate

To a suspension of ethyl (E)-3-(2-methylphenyl)-2-propenoate (20.0 g; 105 mmol) and NBS (19.64 g; 110.3 mmol) in refluxing CCl₄ was added benzoyl peroxide (1.27 g) and the mixture was stirred for 12 h. The solution was cooled to r.t., filtered and concentrated. Flash

5 chromatography with EtOAc:hexane 5:95 yielded the title compound (14.18 g, 50%).

^1H NMR (CDCl_3) δ 1.30 (3H, t), 4.25 (2H, q), 4.60 (2H, s), 6.45 (1H, d), 7.30 (3H, m), 7.57 (1H, m) and 8.05 (1H, d).

10 Step 2 Ethyl (E)-3-(2-((3-phenoxy)benzyloxy)phenyl)-2-propenoate

To a solution of 3-phenoxybenzylalcohol (545 mg; 2.72 mmol) in DMF (5 ml) was added NaH (92 mg; 3.1 mmol; 80% dispersion in oil) and ethyl (E)-3-(2-(bromomethyl)phenyl)-2-propenoate (810 mg; 3.0 mmol). After 6 h at r.t., 20 mg extra NaH was added. The final mixture
15 was stirred at r.t. for 10 h then quenched using 0.3 ml of AcOH. The mixture was diluted with Et_2O (25 ml), washed with water (3 x 20 ml) and brine, dried over MgSO_4 and concentrated. Flash chromatography with EtOAc:toluene 5:95 afforded the desired material.

Yield: 822 mg, 78%.

20

Step 3

The ester of step 2 was hydrolyzed as in example 61, step 3, to yield the title acid. The sodium salt was prepared as in examples 6 and 7, step 3.

25

MS (APCI, neg.) 359.0 (M-1).

EXAMPLE 71

SODIUM (E)-3-(2-(2-PHENOXYBENZYLOXYMETHYL)PHENYL)
-2-PROPENOATE

30

This product was prepared as in example 70 from 2-phenoxybenzyl alcohol.

MS (APCI, neg.) 359.0 (M-1).

EXAMPLE 74

35 SODIUM (E)-3-(2-(3-(2-BENZYLOXYPHENOXY)PROPOXY)PHENYL)-2-PROPENOATE

Step 1 Methyl (E)-3-(2-(3-bromopropoxy)phenyl)-2-propenoate

To a solution of methyl 2-hydroxycinnamate (1.31 g; 7.33 mmol) in 50 ml acetone was added 1,3-dibromopropane (1.50 ml; 14.8 mmol) and K_2CO_3 (4.36 g; 13.4 mmol). The mixture was heated to reflux
40

- 5 for 12h, cooled to r.t, diluted with hexane (50 ml), filtered and finally concentrated to afford the title product (1.96 g; 50% pure), which was used as such in the next step.

Step 2

- 10 2-Benzyloxyphenol (obtained from catechol, NaH, and benzyl bromide as in examples 6 and 7, step 1) was treated with NaH and the product of step 1 as in examples 6 and 7, step 1 to afford the ester of the title product. This ester was hydrolyzed as in example 61, step 3 to yield the acid. The sodium salt was prepared as in examples 6 and 7,
15 step 3.

MS (APCI, neg.) 403.1 (M-1), 233.1, 207.1.

EXAMPLE 75

- 20 SODIUM (E)-3-(2-((E)-3-(2-(1-PHENYLETHOXY)-3-METHYLPHENYL)-2-PROPENYL)PHENYL)-2-PROPENOATE

- 1-Phenylethanol was obtained by reduction of acetophenone with NaBH₄ in THF:MeOH. It was then reacted with the ester of example 61, step 1, via a Mitsunobu reaction (DIAD, Ph₃P, THF:CH₂Cl₂, Synth. Commun. 1994, 24, 1049), to yield the ester of the title compound.
25 This ester was hydrolyzed as in example 61, step 3, to give the title acid.

- The sodium salt was prepared as in examples 6 and 7, step 3.

MS (APCI, neg.) 397.1 (M-1), 293.0, 275.3, 233.2.

- 30 EXAMPLES 77 AND 78

SODIUM (E)-3-(2-((E)-3-(3-PHENOXYPHENYL)-1-PROPENYL)PHENYL)-2-PROPENOATE AND SODIUM (E)-3-(2-((E)-3-(3-PHENOXYPHENYL)-2-PROPENYL)PHENYL)-2-PROPENOATE

- 35 Step 1 1-bromo-3-phenoxybenzene

- To a solution of phenol (5.08g; 54mmol) in 30 ml dry DMF at 0°C was added portionwise NaH (1.98 g; 66 mmol; 80% dispersion in oil). The mixture was stirred 30 min at r.t. then 1,3-dibromobenzene (33 ml; 273 mmol) and Cu₂O (3.95 g; 28 mmol) were added. The final mixture
40 was heated to reflux for 4h, cooled to r.t., diluted with Et₂O (200 ml), washed with water (3 x 200 ml), NaOH (1.0 M; 2 x 100 ml) and brine,

5 Step 2 3-phenylbenzofuran-7-yl-bromide

A mixture of 2-(2-bromophenoxy)-1-phenyl-1-ethanone (6.31 g) and polyphosphoric acid (285 g) was stirred at 95°C for 6 h. The resulting solution was cooled to 50°C, poured in water (2 L), extracted with Et₂O (2 x 1 L). The combined organic extracts were washed with
 10 water (4 x 500 ml) and brine, dried over MgSO₄ and concentrated. The residual solid was filtered on a plug of silica gel using Et₂O. Recrystallization in hot hexane yielded the title compound (4.63g; 78%).

Step 3

15 Using the procedure of examples 77 and 78, steps 2 and 3, the bromide of step 2 was transformed to the title acid. The sodium salts were prepared as in examples 6 and 7, step 3.
 MS (APCI, neg.) 379.4 (M-1), 335.1.

20

EXAMPLES 81 AND 82

N2-((E)-3-(2-((E)-3-PHENYL-1-PROPENYL)PHENYL)-2-PROPENOYL)-2-
 THIOPHENESULFONAMIDE AND N2-((E)-3-(2-((E)-3-PHENYL-2-
PROPENYL)PHENYL)-2-PROPENOYL)-2-
THIOPHENESULFONAMIDE

25

These acylsulfonamides were prepared from the cinnamic acids of examples 25 and 26 following the procedure of Synlett 1995, 1141.
 MS (APCI, neg.) 408.2 (M-1).

EXAMPLES 83 AND 84

30

N2-((E)-3-(2-((E)-3-(4-METHOXYPHENYL)-1-PROPENYL)PHENYL)-2-
 PROPENOYL)-2-THIOPHENESULFONAMIDE AND N2-((E)-3-(2-((E)-3-
 (4-METHOXYPHENYL)-2-PROPENYL)PHENYL)-2-PROPENOYL)-2-
THIOPHENESULFONAMIDE

35

These acylsulfonamides were prepared from the cinnamic acids of examples 38 and 39 following the procedure of Synlett 1995, 1141.
 MS (APCI, neg.) 438.1 (M-1), 233.2.

5 WHAT IS CLAIMED IS:

1. A compound represented by formula II:



II

10 or a pharmaceutically acceptable salt or hydrate thereof, wherein:

Ar¹ is an aryl or heteroaryl group, optionally substituted with R¹ or R³;

R¹ is Y_m-R², Y_m-Ar³, halogen, N(R⁵)₂, CN, NO₂, C(R⁶)₃, CON(R⁵)₂, S(O)_nR⁷ or OH;

15 Y represents a linker between R² or Ar³ and Ar¹ containing 0-4 carbon atoms and not more than one heteroatom selected from O, N and S, said linker optionally containing CO, S(O)_n, -C=C- or an acetylenic group, and said linker being optionally substituted by R²;

m is 0 or 1;

20 n is 0, 1 or 2;

R² represents H, F, CHF₂, CF₃, lower alkyl or hydroxyC₁₋₆ alkyl, or two R² groups may be joined together and represent a carbocyclic ring of up to six members, said ring containing not more than one heteroatom selected from O, N and S;

25 Ar³ represents an aryl or heteroaryl group, optionally substituted with R³;

R³ is R⁴, halogen, haloC₁₋₆alkyl, N(R⁵)₂, CN, NO₂, C(R⁶)₃, CON(R⁵)₂, OR⁴, SR⁴ or S(O)_nR⁷;

30 R⁴ is H, lower alkyl, lower alkenyl, lower alkynyl, CHF₂ or CF₃;

R⁵ is R⁴, Ph or Bn, or two R⁵ groups in combination with the atom to which they are attached represent a ring of up to 6 members containing carbon atoms and up to 2 heteroatoms selected from O, N and S;

35 R⁶ is H, F, CF₃ or lower alkyl, or two R⁶ groups may be taken together and represent a ring of up to 6 members containing carbon atoms and 0-2 heteroatoms selected from O, N and S;

R⁷ is lower alkyl, lower alkenyl, lower alkynyl, CHF₂, CF₃, N(R⁵)₂, Ph(R⁸)₂ or CH₂Ph(R⁸)₂;

40 R⁸ is R⁴, OR⁴, SR⁴ or halogen

SCANNED 1

5 W represents a 3-6 membered linking group containing 0 to 2 heteroatoms selected from O, N and S, said linking group optionally containing CO, S(O)_n, C=C or an acetylenic group, and optionally being substituted with R⁹;

R⁹ is R², lower alkenyl, lower alkynyl, OR⁴ or SR⁴;

10 Ar² represents an aryl or heteroaryl group, optionally substituted with R³;

R¹⁰ represents R⁴, halogen, N(R⁵)₂, CN, NO₂, C(R⁶)₃, OR⁴, SR⁴ or S(O)_nR⁷;

15 X represents a linker which is attached to Ar² ortho to the attachment of W, said linker containing 0-4 carbon atoms and not more than one heteroatom selected from O, N and S, said linker further optionally containing CO, S(O)_n, C=C or an acetylenic group, and said linker being optionally substituted with R¹¹;

R¹¹ is R⁹;

20 Q represents a member selected from the group consisting of: CO₂H, tetrazole, SO₃H, hydroxamic acid, CONHSO₂R¹² and SO₂NHCOR¹²;

25 R¹² represents a member selected from the group consisting of: CF₃, lower alkyl, lower alkenyl, lower alkynyl and ZAr⁴, wherein Z is an optional linker containing 0-4 carbon atoms, optionally substituted with R¹³;

R¹³ is R⁹;

Ar⁴ is an aryl or heteroaryl group optionally substituted with R¹⁴, and

30 R¹⁴ is R¹⁰ or NHCOMe.

2. A compound in accordance with claim 1 wherein R¹ is OH, OCH₂Ar³, SCH₂Ar³, OAr³, SAR³ or NR²CH₂Ar³.

35 3. A compound in accordance with claim 1 wherein Ar³ is an aryl or heteroaryl group selected from the group consisting of benzene, pyridine, thiophene, furan, oxazole and thiazole, said group being optionally substituted with R³.

40 4. A compound in accordance with claim 1 wherein Ar² is an aryl or heteroaryl group selected from the group consisting of:

5 benzene, pyridine, thiophene, furan, oxazole and thiazole, said group being optionally substituted with 1-5 groups selected from R⁴, OR⁴, SR⁴ and halogen.

10 5. A compound in accordance with claim 1 wherein W is selected from the group consisting of: CH₂OCH₂, (CH₂)₃, CH₂CH=CH, CH=CHCH₂, CH(OH)CH=CH, CH=CHCH(OH), CH₂C≡C, C≡CCH₂, 1,2-c-Pr-CH₂ and -1,2-c-Pr-CH₂.

15 6. A compound in accordance with claim wherein X is selected from the group consisting of: (CH₂)₂, CH=CH, C≡C and 1,2-c-Pr.

7. A compound in accordance with claim 1 wherein Q is CO₂H or tetrazole.

20 8. A compound in accordance with claim 1 wherein Z represents a 0-2 carbon atom linker that is unsubstituted.

25 9. A compound in accordance with claim 1 wherein Ar⁴ represents an aryl or heteroaryl group selected from the group consisting of benzene, pyridine, thiophene, furan, oxazole, thiazole, 1,3,4-thiadiazole and naphthalene, said group being optionally substituted with R³.

30 10. A compound in accordance with claim 1 wherein:
Ar¹ is an aryl or heteroaryl group substituted by R¹ and R³;
R¹ is OH, OCH₂Ar³, SCH₂Ar³, OAr³, SAr³ or NR²CH₂Ar³;
Ar³ is selected from the group consisting of benzene, pyridine, thiophene, furan, oxazole and thiazole, said group being optionally substituted with R³;

35 Ar² represents a member selected from the group consisting of: benzene, pyridine, thiophene, furan, oxazole, and thiazole, said group being optionally substituted with 1-4 members selected from the group consisting of: R⁴, OR⁴, SR⁴ and halogen;

40 W is selected from the group consisting of: CH₂OCH₂, (CH₂)₃, CH₂CH=CH, CH=CHCH₂, CH(OH)CH=CH, CH=CHCH(OH), CH₂C≡C, C≡CCH₂, 1,2-c-Pr-CH₂- and -CH₂-1,2-c-Pr-;

5 X is selected from the group consisting of: $(\text{CH}_2)_2$, $\text{CH}=\text{CH}$,
 $\text{C}\equiv\text{C}$ and 1,2-c-Pr;
 and Q is CO_2H or tetrazole.

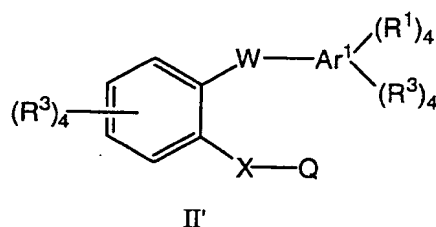
11. A compound in accordance with claim 1 wherein:
 10 Ar^1 is an aryl or heteroaryl group optionally substituted
 with R^1 and R^3 ;
 R^1 is OH , OCH_2Ar^3 , SCH_2Ar^3 , OAr^3 , SAr^3 or $\text{NR}_2\text{CH}_2\text{Ar}^3$;
 Ar^3 represents a member selected from the group
 consisting of: benzene, pyridine, thiophene, furan, oxazole or thiazole,
 15 said group being optionally substituted with R^3 ;
 W is selected from the group consisting of: CH_2OCH_2 ,
 $(\text{CH}_2)_3$, $\text{CH}_2\text{CH}=\text{CH}$, $\text{CH}=\text{CHCH}_2$, $\text{CH}(\text{OH})\text{CH}=\text{CH}$, $\text{CH}=\text{CHCH}(\text{OH})$,
 $\text{CH}_2\text{C}\equiv\text{C}$ or $\text{C}\equiv\text{CCH}_2$;
 Ar^2 represents a member selected from the group
 20 consisting of: benzene, pyridine, thiophene, furan, oxazole or thiazole,
 said group being optionally substituted with R^3 ;
 X is selected from the group consisting of: $(\text{CH}_2)_2$,
 $\text{CH}=\text{CH}$, $\text{C}\equiv\text{C}$ and 1,2-c-Pr;
 Q is $\text{CONHSO}_2\text{ZAr}^4$;
 25 Z is a 0-2 carbon linker and is unsubstituted;
 Ar^4 is selected from the group consisting of: benzene,
 pyridine, thiophene, furan, oxazole, thiazole, 1,3,4-thiadiazole and
 naphthalene, and is optionally substituted by R^3 .

12. A compound in accordance with claim 1 wherein:
 Ar^1 is benzene or thiophene substituted in position 2 and/or
 position 4 relative to the attachment of W with a member selected from
 the group consisting of: OH , OCH_2Ar^3 , SCH_2Ar^3 , OAr^3 , SAr^3 and
 $\text{NR}_2\text{CH}_2\text{Ar}^3$, and is optionally substituted in position 3 with a member
 35 selected from the group consisting of: OMe , OCHF_2 and lower alkyl;
 Ar^3 is benzene or thiophene, optionally substituted with R^3 ;
 W is selected from the group consisting of: CH_2OCH_2 ,
 $(\text{CH}_2)_3$, $\text{CH}_2\text{CH}=\text{CH}$, $\text{CH}=\text{CHCH}_2$, $\text{CH}(\text{OH})\text{CH}=\text{CH}$ and $\text{CH}=\text{CHCH}(\text{OH})$,
 Ar^2 is benzene or thiophene, optionally substituted with 1-4
 40 members selected from R^4 , OR^4 , SR^4 and halogen;

- 5 X represents a member selected from the group consisting of: $(\text{CH}_2)_2$, $\text{CH}=\text{CH}$ and 1,2-c-Pr, and
Q is CO_2H .

- 10 13. A compound in accordance with claim 1 wherein:
 Ar^1 is a benzene or a thiophene unsubstituted or substituted in position 2 and/or position 4 relative to the point of attachment to W by a member selected from the group consisting of: OH , OCH_2Ar^3 , SCH_2Ar^3 , OAr^3 , SAr^3 and $\text{NR}^2\text{CH}_2\text{Ar}^3$; and is optionally substituted at position 3 with one member selected from the group consisting of: OMe ,
15 OCHF_2 and lower alkyl;
 Ar^3 is benzene or thiophene, optionally substituted with R^8 ;
W is selected from the group consisting of: CH_2OCH_2 , $(\text{CH}_2)_3$, $\text{CH}_2\text{CH}=\text{CH}$, $\text{CH}=\text{CHCH}_2$, $\text{CH}(\text{OH})\text{CH}=\text{CH}$ and $\text{CH}=\text{CHCH}(\text{OH})$;
 Ar^2 is benzene or thiophene, optionally substituted with R^4 ,
20 OR^4 , SR^4 or halo;
X is selected from the group consisting of: $(\text{CH}_2)_2$, $\text{CH}=\text{CH}$ and 1,2-c-Pr,
Q is $\text{CONHSO}_2\text{ZAr}^4$,
Z is a bond or CH_2 , and
25 Ar^4 is selected from the group consisting of: benzene, thiophene, 1,3,4-thiadiazole and naphthalene and is substituted with R^8 .

14. A compound represented by formula II':



- 30 or a pharmaceutically acceptable salt or hydrate thereof, wherein:
 Ar^1 represents phenyl, naphthyl, benzofuranyl or methylenedioxyphenyl;
 R^1 represents H, OH, C_{1-6} alkyl, C_{1-6} alkoxy, hydroxy C_{1-6} alkyl, aryl, aryloxy, arylalkoxy, haloaryl, haloheteroaryl,

5 haloarylalkoxy, alkylaryl, haloalkylarylalkoxy, haloarylalkoxy and
haloheteroarylalkoxy;

R^3 represents R^4 , halogen, OR^4 or SR^4 ;

R^4 represents H, lower alkyl, lower alkenyl, lower alkynyl,
CHF₂ or CF₃;

10 X represents a member selected from the group consisting
of:

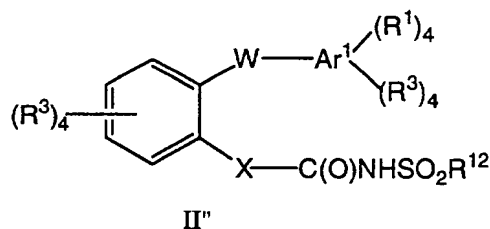
-(CH₂)₁₋₂-, 1,2-c-Pr-, -CH=CH-, -CH₂O-, -C≡CCH₂-, -C≡C-, and -CH₂-
C≡C-;

15 W represents a member selected from the group consisting
of:

-(CH₂)₃₋₆-, -CH₂CH=CH-, -CH=CHCH₂-, -CH(OH)CH=CH-,
-CH=CHCH(OH)-, -CH₂-1,2-c-Pr-, -1,2-c-Pr-CH₂-, -CH₂-O-CH₂-,
-O-(CH₂)₁₋₃-O-, -CH₂-NHC(O)-, -CF₂CH=CH-, -CH=CHCF₂-, -CH₂CH₂-
S-, -S-CH₂CH₂-, -CH₂CH₂-SO₂-, -SO₂-CH₂CH₂-, -O-(CH₂)₁₋₃-, -(CH₂)₁₋₃-
20 O- and -CH=CHCH₂CH₂-, and

all other variables are as defined in claim 1.

15. A compound represented by formula II'':



25

or a pharmaceutically acceptable salt or hydrate thereof, wherein:

Ar^1 represents phenyl, naphthyl, benzofuranyl or
methylenedioxyphenyl;

30 R^1 represents H, OH, C₁₋₆alkyl, C₁₋₆alkoxy, hydroxyC₁₋₆alkyl, aryl, aryloxy, arylalkoxy, haloaryl, haloheteroaryl,
haloarylalkoxy, alkylaryl, haloalkylarylalkoxy, haloarylalkoxy and
haloheteroarylalkoxy;

R^3 represents R^4 , halogen, OR^4 or SR^4 ;

5 R^4 represents H, lower alkyl, lower alkenyl, lower alkynyl, CHF_2 or CF_3 ;

X represents a member selected from the group consisting of:

10 $-(CH_2)_{1-2}$ -, $-1,2-c-Pr$ -, $-CH=CH$ -, $-CH_2O$ -, $-C\equiv CCH_2$ -, $-C\equiv C$ -,
and $-CH_2-C\equiv C$ -;

W represents a member selected from the group consisting of:

15 $-(CH_2)_{3-6}$ -, $-CH_2CH=CH$ -, $-CH=CHCH_2$ -, $-CH(OH)CH=CH$ -,
 $-CH=CHCH(OH)$ -, $-CH_2-1,2-c-Pr$ -, $-1,2-c-Pr-CH_2$ -, $-CH_2-O-CH_2$ -, $-O-$
 $(CH_2)_{1-3}-O$ -, $-CH_2-NHC(O)$ -, $-CF_2CH=CH$ -, $-CH=CHCF_2$ -, $-CH_2CH_2-S$ -, $-$
 $S-CH_2CH_2$ -, $-CH_2CH_2-SO_2$ -, $-SO_2-CH_2CH_2$ -, $-O-(CH_2)_{1-3}$ -, $-(CH_2)_{1-3}-O$ -
and $-CH=CHCH_2CH_2$ -, and

20 R^{12} is selected from the group consisting of: C_{1-6} alkyl, thienyl, phenyl, naphthyl, biphenyl, quinoliny, thiadiazolyl, tetrazolyl, $-CH=CH$ -phenyl, said thienyl, phenyl, naphthyl, biphenyl, quinoliny, thiadiazolyl, tetrazolyl and $-CH=CH$ -phenyl groups being optionally substituted with R^3 .

25 16. A compound in accordance with claim 1 falling within the following table:

Table I					
(Ar ¹ -W-Ar ² -X-Q)					
Ex	Ar ¹	W	Ar ²	X	Q
1	2-(BnO)-3-MePh	$(CH_2)_3$	1,2-Phe	$(CH_2)_2$	CO ₂ H
2	2-(BnO)-3-MePh	$CH_2CH=CH$	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
3	2-(BnO)-3-MePh	$CH=CHCH_2$	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
4	2-((2-Cl-4-FPh)CH ₂ O)-3-CF ₃ Ph	$CH_2CH=CH$	1,2-Phe	CH=CH	CO ₂ H

5	2-((2-Cl-4-FPh)CH ₂ O)-3-CF ₃ Ph	CH=GHCH ₂	1,2-Phe	CH=CH	CO ₂ H
6	2-(BnO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
7	2-(BnO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
8	4-(BnO)-3,5-(MeO) ₂ Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
9	4-(BnO)-3,5-(MeO) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
10	2-(BnO)-5-AcPh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
11	2-(BnO)-5-AcPh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
12	2-(BnO)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
13	2-(BnO)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
14	4-(BnO)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
15	4-(BnO)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
16	2-(BnO O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH ₂	CO ₂ ⁻ X ⁺
17	2-(BnO)-3-MePh	CH=CHCH ₂	1,2-Phe	CH ₂	CO ₂ ⁻ X ⁺
18	2-(BnO)-3-MePh	CH ₂ CH=CH	5-Cl-1,2-Phe	CH ₂	CO ₂ ⁻ X ⁺
19	2-(BnO)-3-MePh	CH=CHCH ₂	5-Cl-1,2-Phe	CH ₂	CO ₂ ⁻ X ⁺
20	4-(BnO)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	1,2-c-Pr	CO ₂ H
21	2-(BnO)-3-MePh	CH=CHCH ₂	4,5-(MeO) ₂ -1,2-Phe	CH=CH	CO ₂ H
22	2-(BnO)-3-MePh	CH ₂ CH=CH	4,5-(MeO) ₂ -1,2-Phe	CH=CH	CO ₂ H
23	3,4-(methylene dioxy)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
24	3,4-(methylene dioxy)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
25	Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
26	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
27	2-(HO)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
28	2-(BnO)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
29	2-(BnO)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
30	2-((7-Cl-2-quinoliny)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
31	2-((7-Cl-2-quinoliny)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
32	2-(BnO)-3-MePh	(CH ₂) ₃	1,2-Phe	bond	CO ₂ H
33	2-(BnO)-3-MePh	CH=CHCH ₂	1,2-Phe	bond	CO ₂ ⁻ X ⁺
34	2-(BnO)-3-MePh	CH ₂ CH=CH	1,2-Phe	bond	CO ₂ ⁻ X ⁺
35	2-(BnO)-3-MePh	(CH ₂) ₃	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
36	2-(BnO)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
37	4-(BnO)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺

38	4-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
39	4-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
40	3,4-(MeO) ₂ Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
41	3,4-(MeO) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
42	2-(BnO)Ph	CH(OH)CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
43	2-(BnO)-3-MePh	(CH ₂) ₃	1,2-Phe	(CH ₂) ₂	CON ⁻ X ⁺ SO ₂ -2-thienyl
44	4-(BnO)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CON ⁻ X ⁺ SO ₂ -2-thienyl
45	4-(BnO)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CON ⁻ X ⁺ SO ₂ -2-thienyl
46	2-(BnO)-3-MePh	CH ₂ -1,2-c-Pr	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
47	2-(BnO)-3-MePh	1,2-c-Pr-CH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
48	2-(BnO)-3-MePh	CH(OH)CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
49	2-(BnO)-3-MePh	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
50	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
51	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH(OH)CH=CH	1,2-Phe	CH=CH	CO ₂ H
52	2-((4-FPh)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
53	2-((4-FPh)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
54	2-((3,4-F ₂ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
55	2-((3,4-F ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
56	2-((3,5-F ₂ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
57	2-((3,5-F ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
58	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-(HOCH ₂)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
59	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-(HOCH ₂)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
60	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
61	2-((2,6-Cl ₂ Ph)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
62	2-((4-CF ₃ Ph)CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
63	2-((4-CF ₃ Ph)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺

64	2-((4-(CHF ₂ O)Ph) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
65	2-((4-(CHF ₂ O)Ph) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
66	2-((4-CF ₃ Ph)CH ₂ O) -3-(HOCH ₂)Ph	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
67	2-((4-CF ₃ Ph)CH ₂ O) -3-(HOCH ₂)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
68	2-((4-CF ₃ Ph)CH ₂ O) -3-MePh	CH=CHCH(OH)	1,2-Phe	CH=CH	CO ₂ H
69	2-(PhCH ₂ O)-3- (HOCH ₂)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
70	3-(PhO)Ph	CH ₂ OCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
71	2-(PhO)Ph	CH ₂ OCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
72	3-(BnO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
73	3-(BnO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
74	2-(BnO)Ph	O(CH ₂) ₃ O	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
75	2-(PhCHMeO)-3 -MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
76	2-(PhCHMeO)-3 -MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
77	3-(PhO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
78	3-(PhO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
79	3-Phbenzofuran-7-yl	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
80	3-Phbenzofuran-7-yl	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ ⁻ X ⁺
81	Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
82	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ -2-thienyl
83	4-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ -2- thienyl
84	4-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ -2- thienyl
85	2-(BnO)-1-naphthyl	CH ₂ NHCO	1,2-Phe	CH=CH	CO ₂ H
86	2-((2-Cl-4-FPh) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
87	2-((2-Cl-4-FPh) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
88	2-((2,4-F ₂ Ph)CH ₂ O) -3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
89	2-((2,4-F ₂ Ph) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
90	2-((2,4,6-F ₃ Ph) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H

91	2-((2,4,6-F ₃ Ph) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
92	2-((2,6-Cl ₂ -4-FPh) CH ₂ O)-3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
93	2-((2,6-Cl ₂ -4-FPh) CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
94	2-((2,4-F ₂ Ph)CH ₂ O) -3-(CHF ₂ O)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
95	2-((2,4-F ₂ Ph)CH ₂ O) -3-(CHF ₂ O)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
96	2-((4-FPh)CH ₂ O) -3-MePh	CF ₂ CH=CH	1,2-Phe	CH=CH	CO ₂ H
97	2-((4-FPh)CH ₂ O) -3-MePh	CH=CHCF ₂	1,2-Phe	CH=CH	CO ₂ H
98	2-((4-FPh)CH ₂ O) -3-MePh	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ - (4-i-PrPh)
99	2-((4-FPh)CH ₂ O) -3-MePh	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ - (4-t-BuPh)
100	2-((4-FPh)CH ₂ O) -3-MePh	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ - (4-(MeO)Ph)
101	2-((4-FPh)CH ₂ O) -3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ - (2,3-Cl ₂ Ph)
102	2-((4-FPh)CH ₂ O) -3-MePh	CH=CHCH ₂	4-Cl-1,2- Phe	CH=CH	CONHSO ₂ - (5-Br-2- (MeO)Ph)
103	2-((4-FPh)CH ₂ O) -3-MePh	(CH ₂) ₂ S	3-F-1,2-Phe	CH=CH	CONHSO ₂ - (2,3,4-Cl ₃ Ph)
104	2-((4-FPh)CH ₂ O)-3- MePh	(CH ₂) ₂ S	6-CF ₃ -1,2- Phe	CH=CH	CONHSO ₂ - (5-F-2-MePh)
105	2-((4-FPh)CH ₂ O)-3- MePh	(CH ₂) ₂ S	4,5-F ₂ -1,2- Ph	CH=CH	CONHSO ₂ - (2,5-Me ₂ Ph)
106	2-((4-FPh)CH ₂ O)-3- MePh	(CH ₂) ₂ SO ₂	1,2-Phe	CH=CH	CONHSO ₂ - (4-CF ₃ Ph)
107	2-((4-FPh)CH ₂ O)-3- MePh	(CH ₂) ₂ SO ₂	1,2-Phe	CH=CH	CONHSO ₂ -2- naphthyl
108	2-((4-FPh)CH ₂ O)-3- MePh	CH=CHCH ₂	3-F-1,2-Phe	CH=CH	CONHSO ₂ - (3-Cl-4-FPh)
109	2-((4-FPh)CH ₂ O)-3- MePh	SO ₂ (CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ - (4-n-PrPh)
110	2-((4-FPh)CH ₂ O)-3- (MeO)Ph	SO ₂ (CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ - (2-ClPh)
111	2-((4-FPh)CH ₂ O)-3- (MeO)Ph	SO ₂ (CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ - (4-FPh)
112	2-((4-FPh)CH ₂ O)-3- (MeO)Ph	S(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ - (2-PhPh)

113	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	S(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(2-CF ₃ Ph)
114	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	S(CH ₂) ₂	4-t-Bu-1,2-Phe	CH=CH	CONHSO ₂ -(4-Cl-2,5-Me ₂ Ph)
115	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	O(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(2,5-Cl ₂ Ph)
116	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	O(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -(4-Br-2-(CF ₃ O)Ph)
117	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	O(CH ₂) ₂	1,2-Phe	CH=CH	CONHSO ₂ -CH ₂ Ph
118	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	(CH ₂) ₂ O	1,2-Phe	CH=CH	CONHSO ₂ -1-naphthyl
119	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	(CH ₂) ₂ O	4,5-F ₂ -1,2-Phe	CH=CH	CONHSO ₂ -(2-FPh)
120	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	(CH ₂) ₂ O	1,2-Phe	CH=CH	CONHSO ₂ -(2,4-Cl ₂ Ph)
121	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ -CH=CHPh
122	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ -(3,5-(CF ₃) ₂ Ph)
123	2-((4-FPh)CH ₂ O)Ph	(CH ₂) ₃	1,2-Phe	CH=CH	CONHSO ₂ -(2,5-Cl ₂ -3-thienyl)
124	2-((4-FPh)CH ₂ O)Ph	(CH ₂) ₄	3-F-1,2-Phe	CH=CH	CONHSO ₂ -(3-BrPh)
125	2-((4-FPh)CH ₂ O)Ph	(CH ₂) ₄	3-MeO-1,2-Phe	CH=CH	CONHSO ₂ -(2-BrPh)
126	2-((4-FPh)CH ₂ O)Ph	(CH ₂) ₄	1,2-Phe	CH=CH	CONHSO ₂ -(2-NO ₂ Ph)
127	2-((4-FPh)CH ₂ O)Ph	(CH ₂) ₅	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(3-ClPh)
128	2-((4-FPh)CH ₂ O)Ph	(CH ₂) ₅	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(4-(CF ₃ O)Ph)
129	2-HOPh	CH=CH(CH ₂) ₂	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -8-quinolinyl
130	2-((4-FPh)CH ₂ O)Ph	CH=CH(CH ₂) ₂	5-(CF ₃ O)-1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(3,4-Cl ₂ Ph)
131	4-((2,6-Cl ₂ -4-FPh)CH ₂ O)-3-MePh	CH=CH(CH ₂) ₂	3-F-1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(4-EtPh)
132	2-((4-FPh)CH ₂ O)Ph	CH ₂ CH=CH	1,2-Phe	(CH ₂) ₂	CONHSO ₂ -(4-Cl-2-NO ₂ Ph)

133	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	4,5-F ₂ -1,2-Phe	CH=CH	CONHSO ₂ - (2-Cl-3-Br-5-thienyl)
134	2-((4-FPh)CH ₂ O)Ph	CH ₂ CH=CH	4,5-F ₂ -1,2-Phe	CH=CH	CONHSO ₂ - (3,4-(MeO) ₂ Ph)
135	2-HOPh	CH=CHCH ₂	4,5-F ₂ -1,2-Phe	CH=CH	CONHSO ₂ - (2,5-Cl ₂ -3-Br-4-thienyl)
136	4-((4-FPh)CH ₂ O)-3-(MeO)Ph	CH ₂ CH=CH	4,5-F ₂ -1,2-Phe	CH=CH	CONHSO ₂ - (4-Br-2,5-F ₂ Ph)
137	4-((4-FPh)CH ₂ O)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ - (5-(AcNH)-1,3,4-thiadiazol-2-yl)
138	4-((4-FPh)CH ₂ O)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ - (2,3,4,5,6-F ₅ Ph)
139	4-((2-Cl-4-FPh)CH ₂ O)-3-MePh	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ - (2-CNPh)
140	2-((4-FPh)CH ₂ O)Ph	CH ₂ CH=CH	4-F-1,2-Phe	CH=CH	CONHSO ₂ - (2-Cl-6-MePh)
141	2-HOPh	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ - (2,4,6-Me ₃ Ph)
142	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ - (2,3-Br ₂ -2-thienyl)
143	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	CH ₂ O	CONHSO ₂ - (4-NO ₂ Ph)
144	2-((4-FPh)CH ₂ O)Ph	CH ₂ CH=CH	1,2-Phe	CH ₂ O	CONHSO ₂ - (3,5-Cl ₂ Ph)
145	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	prop-1-yne-1,3-diyl	CONHSO ₂ - (5-Cl-2-thienyl)
146	4-((2,4-F ₂ Ph)CH ₂ O)-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	CH ₂ O	CONHSO ₂ - (4-CF ₃ Ph)
147	2-HO-3-MePh	CH=CHCH ₂	1,2-Phe	CH ₂ O	CONHSO ₂ - (2,4-F ₂ Ph)
148	2-((4-FPh)CH ₂ O)Ph	CH ₂ CH=CH	4-F-1,2-Phe	1,2-ethyne diyl	CONHSO ₂ - (4-CIPh)

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149	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	1,2-ethyne diyl	CONHSO ₂ ⁻ (3-CF ₃ Ph)
150	4-HOPh	CH ₂ CH=CH	1,2-Phe	1,2-ethyne diyl	CONHSO ₂ ⁻ Ph
151	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	prop-2-yne-1,3-diyl	CONHSO ₂ ⁻ (5-Br-2-thienyl)
152	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH ₂ CH=CH	1,2-Phe	1,2-ethynediyl	CONHSO ₂ ⁻ Me
153	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	1,2-c-Pr	CONHSO ₂ ⁻ (2,5-(MeO) ₂ Ph)
154	6-((4-FPh)CH ₂ O)-2-naphthyl	CH ₂ CH=CH	4-F-1,2-Phe	1,2-c-Pr	CONHSO ₂ ⁻ (3-MePh)
155	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	1,2-c-Pr	CONHSO ₂ ⁻ (4-MePh)
156	4-HO-3-(MeO)Ph	CH ₂ CH=CH	1,2-Phe	1,2-c-Pr	CONHSO ₂ ⁻ -n-Bu
157	4-((4-FPh)CH ₂ O)-1-naphthyl	CH=CHCH ₂	1,2-Phe	1,2-c-Bu	CONHSO ₂ ⁻ (2-Cl-4-FPh)
158	Ph	CH ₂ CH=CH	1,2-Phe	CH=CH	CONHSO ₂ ⁻ (2-MePh)
159	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CONHSO ₂ ⁻ -c-Pr
160	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	CO ₂ H
161	4-((2,4-F ₂ Ph)CH ₂ O)-3-(MeO)Ph	(CH ₂) ₃	4-F-1,2-Phe	CH=CH	1H-tetrazol-5-yl
162	2-((4-FPh)CH ₂ O)Ph	CH=CHCH ₂	3-MeO-1,2-Phe	CH=CH	1H-tetrazol-5-yl
163	2,4-((4-FPh)CH ₂ O) ₂ Ph	CH=CHCH ₂	1,2-Phe	CH=CH	1H-tetrazol-5-yl
164	4-HO-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	1,2-c-Pr	1H-tetrazol-5-yl
165	Ph	CH=CHCH ₂	1,2-Phe	(CH ₂) ₂	1H-tetrazol-5-yl
166	2-((4-FPh)CH ₂ O)-3-(MeO)Ph	CH=CHCH ₂	1,2-Phe	CH=CH	SO ₃ H
167	2-((4-FPh)CH ₂ O)-3-MePh	(CH ₂) ₃	4-F-1,2-Phe	(CH ₂) ₂	SO ₃ H

5

wherein X⁺ represents a cation.

5 17. A compound in accordance with claim 16 wherein X⁺
represents a cation selected from the group consisting of: ammonium,
calcium, magnesium, potassium and sodium.

10 18. A pharmaceutical composition comprised of a
compound in accordance with claim 1 in combination with a
pharmaceutically acceptable carrier.

15 19. A pharmaceutical composition in accordance with
claim 18 further comprising a COX-2 selective inhibiting compound.

20 20. A method of treating or preventing a prostaglandin
mediated disease in a mammalian patient in need thereof, comprising
administering to said patient a compound in accordance with claim 1
in an amount which is effective for treating or preventing said
prostaglandin mediated disease.

25 21. A method of treating or preventing a prostaglandin
mediated disease in accordance with claim 20 further comprising
administering to said patient an effective amount of a COX-2 selective
inhibiting compound.

30 22. A method of treating or preventing a prostaglandin
mediated disease in accordance with claim 20 wherein the
prostaglandin mediated disease is selected from the group consisting of:
Pain, fever, inflammation, rheumatic fever, symptoms associated with
influenza or other viral infections, common cold, low back and neck
pain, skeletal pain, post-partum pain, dysmenorrhea, headache,
migraine, toothache, sprains, strains, myositis, neuralgia, synovitis,
arthritis including rheumatoid arthritis, degenerative joint diseases
35 (osteoarthritis), gout, ankylosing spondylitis, bursitis, burns including
radiation and corrosive chemical injuries, sunburns, pain following
surgical and dental procedures, immune and autoimmune diseases,
cellular neoplastic transformations, metastatic tumor growth,
prostaglandin-mediated proliferation disorders such as diabetic
40 retinopathy and tumor angiogenesis, dysmenorrhea, premature labor,
asthma, eosinophil related disorders, Alzheimer's disease, glaucoma,

- 5 bone loss (osteoporosis), promotion of bone formation (treatment of fractures) and other bone diseases such as Paget's disease.

23. A method of treating or preventing an E type prostaglandin mediated disease in a mammalian patient, comprising
10 administering to said patient an amount of an E type prostaglandin ligand in an amount which is effective to treat or prevent said E type prostaglandin mediated disease.

24. A method in accordance with claim 23 further
15 comprising administering a COX-2 selective inhibitor.

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5 TITLE
PROSTAGLANDIN RECEPTOR LIGANDS

10 ABSTRACT OF THE INVENTION

Compounds and methods for treating prostaglandin mediated diseases, and certain pharmaceutical compositions thereof are disclosed. The compounds are represented by formula II:

15
$$\text{Ar}^1\text{-W-Ar}^2\text{-X-Q}$$

II

The compounds of the invention are structurally different from NSAIDs and opiates, and are antagonists of the pain and inflammatory effects of E-type prostaglandins.

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